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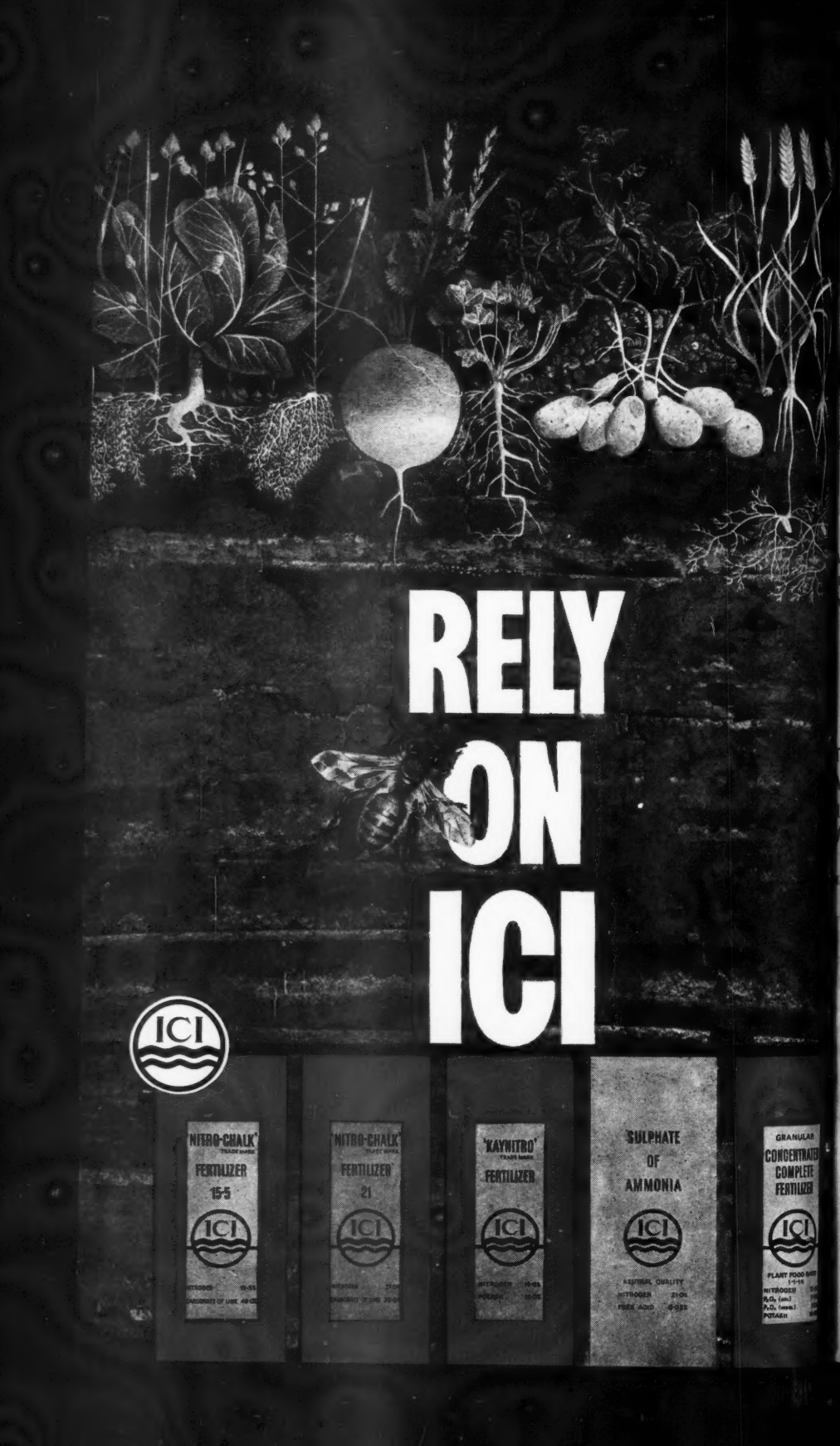
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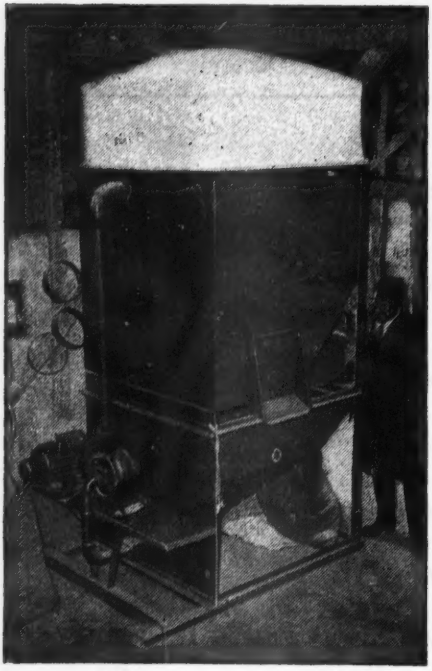

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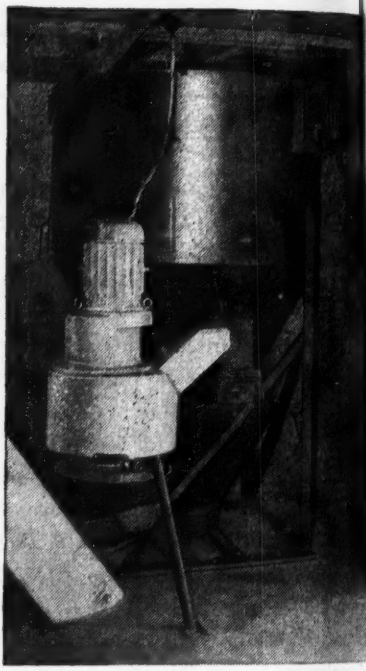

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Hill Shelter-Belt Investigation at Bangor

Professor E. J. ROBERTS, M.A., M.Sc. AND W. BROWN, M.S., B.Sc.

University College of North Wales, Bangor

Very little is known about the effects of shelter on the well-being of sheep and cattle on hill farms. Bangor is carrying out a long-term experiment in an effort to obtain precise information about all the factors involved.

THE need of animals for shelter from excessively cold and wet conditions in winter has long been known. It may not generally be realized, however, that shelter can, on occasions, be valuable even in late spring or summer, especially just after shearing when ewes are said to be more sensitive to cold wind than a naked man. Even in Australia heavy losses may occur after shearing, and research is being made into the subject.

Very little information is available as to how important shelter may be, and to what extent it may affect, if at all, the survival of newly-born lambs, growth, fertility, yield of milk, meat, wool, etc. It is considered by some that, by breeding hardy sheep or cattle, shelter should not be needed. Others maintain that, if an animal has a little dry ground to lie on, it is not seriously affected by wind, rain, and cold; ruminants generate much heat in the course of digestion. It has been pointed out that cattle originated in arctic regions, and that Ben Nevis is, in fact, more severe for animals than the arctic because of the wet conditions; the top of the Pennines has been referred to as "tundra". Another view is that, if an animal is adequately fed, it can stand both cold and wet but this cannot be applied to most hill conditions, since ewes are undernourished at the most critical period of their life, i.e., in the few weeks before and after lambing. Though experience may convince us that such generalizations are, in the main, true, no data are available as to how much the need for shelter can be reduced by improving the other environmental conditions or by breeding a hardier animal.

Possible disadvantages of shelter

There are factors that, under certain conditions, may result in shelter having disadvantages. Heavy losses occur in some years because sheep are buried in drifts of snow that have settled down in the calmer air behind the sheltering wall or wood. Also the crowding of ewes and lambs on the pastures immediately surrounding areas of trees could result in heavy infestation of worms. The length of the period during which grazing animals can take shelter is limited because of the amount of grazing that is necessary to satisfy the needs and appetite of such animals. Where the quality and amount of grazing is low, as it is on mountains, sheep have to spend a greater proportion of their time obtaining grass, thus leaving very little time available for actual sheltering. It is obvious that shelter-belts can only be expected to be beneficial during comparatively short and severe periods of very difficult weather or during an exacting time, such as lambing and an hour or two afterwards.

Site of experimental shelter-belts

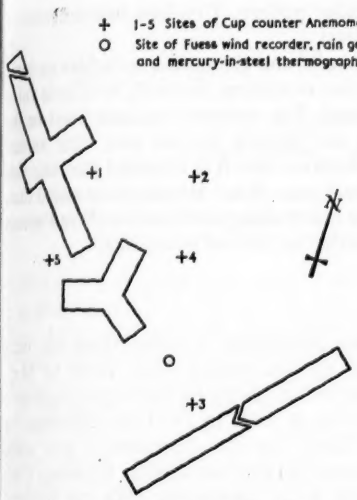
The importance of shelter on the hill, and of obtaining more definite and precise information on the subject, led the College to lay down experimental shelter-belts on the ffridd or in-bye, with the collaboration and financial help of the Ministry of Agriculture, Fisheries and Food. The ffridd at the College Farm is about 400 acres in area and rises from approximately 100 feet to 1,150 feet above sea level. The hill is in an exposed situation and the soil is poor, with frequent boulders and out-crops of rock. About 80 acres have been improved, mostly during and immediately after the War, by ploughing, fertilizing and reseeding; the difficult nature of the ground made it impossible to plough a greater area. Improvement has also included the destruction of bracken by means of the Holt Bracken Crusher and, where the slopes are too steep and uneven for machinery, cutting by hand. The reseeded areas are maintained in the improved condition by grazing with cattle in summer, a small beef herd of 25 Welsh Black cows being kept, as well as 30-40 Friesian heifers. Regular liming and slagging is carried out.

Since management of livestock on the ffridd has reference to shelter, mention may be made of the practice of using it mainly for wintering a flock of 650 Welsh mountain sheep, which graze the unfenced higher mountains during the summer. The summer grazing extends to over 3,000 feet, and flocks are removed from it before winter because of the danger of drifting snow, and because growth of grass is almost at a standstill.

The ffridd, or winter grazing, is of great importance to the hill flockmaster because it governs not only the number of sheep that can be kept, but also the size and condition of both ewes and lambs. If the provision of shelter can improve winter hill grazing in these respects, an important contribution to income can be made. The in-bye is not free from the danger of drifting snow, but an attempt is made to reduce losses from this cause by anticipating blizzards and removing the flock before snow-storms. Such losses can also be reduced by giving the flock a free run of the hill and relying on the sheep to select the safest areas. Hill flockmasters consider that, to some extent, sheep know when bad weather is coming and that they move to the leeward side of hills before severe storms actually arrive. The system of management of many hill flocks takes account of danger of drifting snow. Thus, in the case of the Bangor College Farm mountain flock, the ewes are brought down for tupping during November and are not put back on the unenclosed hills until the spring. We are often tempted to put the flock back on the higher mountains for a month after tupping, that is, during December, but are always afraid of the risk, even though it is not very great, of heavy and prolonged snow in that month.

Nature of belts

Three experimental shelter-belts were planted in the winter of 1957-58, siting, size, shape, and the species of trees having been decided in collaboration with the Ministry, the Forestry Commission, the Meteorological Office and the Forestry Department at Bangor. These authorities are mentioned as an indication of the importance attached to obtaining the best advice in this long-term experiment. The diagram on opposite page shows the siting and shapes of the planted areas, which total 13½ acres; one is



Shape of shelter-belts and sites of meteorological instruments

cross-shaped, one a "Manx-leg", and one rectangular; the width of each enclosure is 44 yards.

The species selected for planting were Mountain pine (two rows on the outside), Sitka spruce, Japanese larch, and Contorta pine. The total number of plants was approximately 18,000. The cost of the three belts, including rabbit-proof fencing, amounted to £1,670. Further expense has been incurred since planting because of the need to replace young trees that did not survive drought or cold conditions, etc. There is also the cost of weeding to prevent the ungrazed grass from smothering the trees. This year, for example, four years after planting, weeding cost approximately £80.

Recording instruments

To assess the sheltering effect of the belts various types of meteorological instruments have been set up which will provide a record of weather conditions before the belts have grown. The recordings being taken include wind speed, rainfall and temperature. The instruments are of a standard pattern, namely five cup counter anemometers, which measure the average wind speed (run of wind) over a determined period, a recording thermometer and a recording rain gauge. To provide a comparison another set of instruments has been sited near sea level. The instrumentation at sea level is a supplement to the normal instruments used at an official meteorological station which is maintained at the College Farm.

The siting of the instruments on the hill land has been arranged in such a way that the effectiveness, or otherwise, of natural shelter provided by the contours of the land, as well as by the belts themselves, can be considered. Since the belts are of different shapes the wind recorders have been sited to compare the value of these different shapes (see diagram). Anemometer 2, for example, is sited to study the sheltering effect of a slope of approximately 1 in 4 immediately to the south of it. Anemometers 3 and 5 are sited in exposed positions where little natural shelter is provided but where there may eventually be some shelter from the belts.

One of the instruments is designed to record the wind direction and the run of the wind simultaneously. This instrument, together with the rain gauge and a mercury-in-steel thermograph sited near it, is regarded as a base to which all other recordings are related. Since the belts are planted at an altitude ranging from 500 to approximately 1,000 feet above sea level, the

instruments are also arranged in a similar pattern. This base instrumentation is approximately 950 feet above sea level.

Recordings are taken three times a week, and the results so far are to some extent of an exploratory nature. Weather recording, by itself, is of little value when related to shelter-belts on hill land. The ultimate measure must be the effect on the grazing animal and on the pasture. So far, very little animal grazing pattern studies have been undertaken but it is intended that this side of the work will be intensified in the next year. It has already been noted that, in wind speeds of 17 miles per hour or more, sheep seek shelter. Wind speeds much higher than this have been recorded on several occasions.

Preliminary results

Some of the preliminary results are interesting. A comparison has been made of three anemometer readings for the period June, 1960, to May, 1961. The results have been condensed for simplicity by making an aggregate of all readings and dividing the total run of wind by the time difference for each anemometer. The three sites chosen for this comparison give some indication of how the contour of the land can provide shelter. Readings from anemometer 2 (at 750 feet above sea level), compared with the lowland (50 feet above sea level), show that altitude does not necessarily exert any influence if the contour of the land is such that shelter is provided from the prevailing wind. The readings of anemometer 2 are nearly always consistently lower than on the lowland when there is a westerly wind. On the other hand, anemometer 3, at 950 feet above sea level, gives a uniformly higher reading. There is very little natural shelter on this site, but after the growth of the shelter-belt it is hoped there will be some reduction in wind speed. Anemometer 5 occasionally records higher readings when there is a westerly wind.

Altitude does, however, have a considerable effect on rainfall. At 950 feet above sea level, in an exposed situation, the rainfall may be approximately 50 per cent higher than at 50 feet above sea level. It is well known that heavy rains accompanied by high wind, especially at lambing time, have a considerable effect on the well-being of the sheep flock. What effects will the shelter-belts have in this respect? Provided the sheep are not encouraged to congregate unnecessarily in shelter and thus lose their natural grazing habits, the belts may improve the number of lambs at marking time.

The experiment also includes an examination of soils inside and outside the belts, so that it may be possible, when the trees are big enough to afford shelter, to find the effects on the soil, especially as regards moisture. The Department of Bio-Chemistry and Soil Science is in charge of this aspect.

The experiment being carried out is a very long-term one and it is much too early to postulate the results. The limiting factor to the commercial farmer may be the cost of establishing such a scheme, together with the loss of what could be valuable grazing land.

Respiratory Diseases of Poultry

J. D. BLAXLAND, M.R.C.V.S.
Central Veterinary Laboratory, Weybridge

Intensive systems of poultry management do not necessarily increase the likelihood of respiratory disease, but financial losses may be greater because more birds are exposed to an infection once it has been introduced.

RESPIRATORY diseases have always been a threat to the economic success of a poultry farm. None of the diseases prevalent today are new. Before the days of intensive methods of husbandry, diseases known as "summer colds", contagious catarrh, diptheria and roup frequently caused flocks to be uneconomic through loss of condition and debility, lowered egg production and infertility or bad hatchability. These terms are no longer in general use, but the bacterial and virus infections which cause them are referred to collectively as "respiratory diseases of poultry".

Certain of the virus diseases were more widespread 20 to 30 years ago, and were responsible for a greater loss relative to the size of the industry than is the usual experience now. For example, the incidence of fowl pox is much lower than before the war. The improvement has been achieved partly through the widespread use of the pigeon pox scab vaccine, but it also seems that the virulence of the fowl pox virus strains encountered in field outbreaks today is distinctly less than it was in earlier years. Another disease, infectious laryngo-tracheitis (I.L.T.) is only of major importance at the present time in Lancashire, whereas from about 1930 to 1940 it was widespread in other parts of the country and occurred in a more virulent form.

Contributory factors

Veterinarians have long appreciated the importance of overcrowding, inadequate ventilation, nutritional deficiencies and close contact between flocks as predisposing factors in outbreaks of respiratory disease. The rapid swing towards intensivism in all types of poultry management was viewed with some apprehension, and the present relatively satisfactory position concerning respiratory diseases throughout the poultry industry may well be a measure of the extent to which poultry owners and managers have acted upon the advice and guidance offered to them. Most authorities agree that, considering the increased poultry population over the country as a whole, the much larger size of the average flock, and the intensive methods of husbandry so widely practised today, the economic loss from respiratory disease has not shown a steep increase. It has been estimated (Coles 1960)* that about three-quarters of the laying stock of the United Kingdom is now housed intensively, with a larger number of birds concentrated into a smaller number of flocks. The adult fowl population of England and Wales was 35,066,000 in 1959 as compared with 19,596,000 in 1948. The growth of the broiler industry during the last six or seven years has transformed the table

*COLES, R. (1960). Development of the Poultry Industry in England and Wales, 1945-59. Poultry World Ltd.

bird industry, and today it would be rare to find a broiler producer with less than 7-10,000 birds per crop; on some farms 30-40,000 birds in one house is not exceptional. If intensivism alone was a major predisposing factor, the disease position might be expected to be much more serious than it is. The average mortality from all causes on most broiler plants varies from less than 3-5 per cent per crop.

The lesson to be learned from these facts is that the actual method or type of management and housing is unimportant, as far as disease control is concerned, provided always that the basic principles of sound husbandry and disease prevention are understood and practised continually.

Where there is overcrowding, inadequate ventilation, and deficient diets, outbreaks of disease may occur and spread rapidly under any type of management. The mixing of different age groups of poultry in flocks on free range is no less dangerous and undesirable than the introduction of maturing pullets into one end of a deep litter laying house before the previous flock has been removed from the other end. The results of mismanagement in flocks under intensive conditions may be economically more serious because there are more birds exposed to infection.

The older generation of poultry farmers often speak as though fresh air and a grass and grain ration possess certain mysterious attributes not available to a flock of birds living in a carefully designed and constructed intensive house and receiving a properly compounded balanced ration. Many people share this view to some extent, forgetting that hens do not possess human sensitivities and that there is no evidence that confinement, provided adequate food and comfort are available, is unpleasant to them. There are poultry breeding farms operating today where stock has been housed intensively for several generations without any detectable deterioration; in fact some of the commercially successful strains of hybrid laying and broiler stock were developed under these intensive conditions. There is, therefore, no reason to assume that poultry flocks reared and bred intensively are genetically less resistant to respiratory disease than those bred and reared under other conditions.

Seven diseases

There are seven quite distinct diseases which primarily affect the upper respiratory tract of the fowl, although respiratory symptoms may also be present in birds infected with several other bacterial and parasitic diseases. The clinical picture presented in most outbreaks of respiratory disease is often very similar and, moreover, two or more infections may sometimes co-exist in the same flock, making it difficult to establish the primary cause of the outbreak. The differential diagnosis of respiratory diseases is impossible without resort to laboratory techniques. Of the seven primary respiratory diseases, four—Newcastle disease (fowl pest), fowl pox, infectious laryngotracheitis and infectious bronchitis—are caused by viruses; in chronic respiratory disease, an infectious agent known as a pleuro-pneumonia-like organism (P.P.L.O.) is implicated, sometimes in association with one of the viruses; and in infectious coryza and coli septicaemia, bacteria cause symptoms and lesions, often indistinguishable in the later stages from those of chronic respiratory disease. Although the laboratory techniques required

for the differentiation of respiratory diseases in poultry are not normally carried out as a routine, a fairly accurate diagnosis can be obtained if the predominating symptoms and lesions are considered in conjunction with the flock history.

It is important to remember that as long as Newcastle disease (fowl pest) remains a notifiable disease in this country its possible presence must always be excluded before detailed investigation of an outbreak of respiratory disease can be carried out. The symptoms in some outbreaks of Newcastle disease are virtually indistinguishable from those of other diseases, and the sudden appearance of respiratory symptoms in a flock of birds, particularly if accompanied by a greenish diarrhoea or nervous symptoms, a drop in egg production in the case of a laying flock, or of food consumption in a broiler flock, should always be reported as suspected fowl pest.

Antibiotics and other therapeutic agents have their uses in some outbreaks of respiratory disease, but the results of flock medication are often disappointing and frequently do not justify the cost incurred. In no other group of diseases is the old adage "prevention is better than cure" more applicable. Adverse environmental conditions are contributory factors on most farms where respiratory diseases are a chronic or recurrent problem. But as already explained, intensivism is not itself of primary significance, although the economic loss from an outbreak of one of these diseases under intensive conditions may often be far more serious today than in the past due to the much larger number of birds exposed to infection on any one farm.

Cleaning and disinfecting the broiler house

Outbreaks of acute respiratory disease with serious mortality are not common in broiler flocks, but a low level of chronic respiratory trouble is often detectable in most broiler houses, particularly if the birds are examined within a few weeks of killing. It follows, therefore, that an efficient programme of cleaning and disinfection of a broiler house, with an adequate interval between one crop and another, is essential if a build-up of infection is to be avoided.

Normally, when a crop of broilers has been marketed satisfactorily and mortality has not been above average, it is not customary to remove all the litter from the house. Litter to be retained should be heaped and allowed to heat before it is spread again for further use; at the same time, the house should be cleaned down and fumigated, or treated with an aerosol disinfectant. When an outbreak of disease has occurred or a build-up of infection is suspected, all the old litter must be taken out and replaced with fresh material after the floor has been scraped and soaked with disinfectant; the brooding and other equipment must be thoroughly cleaned and scrubbed before the usual fumigation or aerosol disinfection is carried out. It should be emphasized that fumigation and the use of aerosols are merely aids to efficient disinfection of a building and that they are relatively inactive against disease organisms protected by a layer of dirt, or present in dried droppings and nasal discharges.

Minor respiratory diseases among growing stock, often described as "colds", will sometimes flare up into serious outbreaks of chronic respiratory disease in the weeks following transfer of the birds into deep litter houses or battery cages. The possibility of local overcrowding or inadequate ventilation

in the rearing units should always be checked, as the depression of egg production and the impaired fertility and hatchability of eggs from a breeding flock can have serious economic consequences when pullets have received an early set-back under these circumstances.

Survivors may be carriers

With some respiratory diseases, notably I.L.T. and chronic respiratory disease, a proportion of the birds surviving an outbreak may remain chronic carriers of infection. Under these circumstances, depopulation is the only certain way of preventing recurrent outbreaks of disease on the farm. If depopulation is not practised, or if it is delayed, recovered birds and those in contact with them must be kept in strict isolation, with no contact whatsoever with replacement stock being reared on the same farm. Steps should also be taken to prevent the introduction of infection into a breeding flock from outside sources. Stock cockerels purchased from another flock should be quarantined for not less than three or four weeks before being placed with the pullet flock.

Before the days of intensivism, nutritional deficiencies were not infrequently a predisposing factor in outbreaks of respiratory disease, and in some outbreaks associated with a general dietetic deficiency of Vitamin A, respiratory symptoms were a prominent feature. The growth of intensivism has been matched by an increase in the scientific knowledge and technical efficiency of the feedingstuffs industry, and deficiency diseases of poultry today, although not uncommonly seen in diagnostic laboratories among individual fowls, are not often caused by direct deficiencies in the food.

Early Potatoes

E. G. ING, N.D.H.
Rosewarne Experimental Horticulture Station

The climate in the south-west of England is particularly suitable for the production of early potatoes, and this article gives much useful information about manuring and the characteristics of different varieties which has been gathered as the result of trials carried out at Rosewarne, in Cornwall.

EARLY potatoes have long been an important crop in the south-west peninsula and especially so in the extreme west of Cornwall. The maritime conditions, when maximum and minimum temperatures are rather higher than in other potato-growing areas from January to March, allow for early planting in late January and in February in most years. Severe frost and snow lying for a few days in February may occasionally delay planting until March. The work may also be hindered by rain, which is usually very heavy during the autumn and winter months, but in deep soils where this moisture can be conserved it can help a lot towards bulking up a crop during a dry spell which may occur in May. Once the crop is through, although the risks of

frost are much less than elsewhere, wind can limit growth. Wind speeds are high, and severe gales may be damaging to potato crops even as late as mid-May.

Several factors may have a bearing on results. In addition to weather, suitable site and soil, crop yields and quality may be considerably affected by source and size of seed, the treatment of it during chitting and planting, by the right manuring and cultivations and the choice of suitable varieties.

Manuring

Very satisfactory crops can be grown on good soils without dung or other common forms of bulky organic matter being applied immediately before a potato crop, and on some soils without these at all for some time. But where success depends so much on rapid growth and early maturity, it is improtant to see that soils are kept in good physical condition, and those which are difficult to maintain in a friable condition particularly benefit from fairly heavy dressings of organic matter. In the past, dung or "pile heap" material consisting of seaweed, crop waste, dung and sand, mixed and composted, have been ploughed in to maintain fertility.

In recent work carried out here with Arran Pilot, as part of a series of trials at various centres throughout the country, comparisons have been made between dung, seaweed compost, straw compost, straw ploughed in and no organic matter. The above have been applied in single and double dressings based on a standard amount of dry matter of each material applied per acre. Nitro-Chalk was applied to the straw before ploughing in. Comparisons have also been made between these materials alone, with added nitrogen, and plots without organic matter but with single, double and treble rates of quick-acting nitrogen. In all cases a basal dressing of superphosphate and sulphate of potash was applied. Dung applied at 20–40 tons per acre, according to dry matter, has generally given slightly better results than the other materials when applied in the presence of nitrogen. In some seasons double or treble dressings of nitrogen without organics have given nearly as good results and have more often given better results than organics without nitrogen. It has been noticeable that all the organic materials have generally given much better crops when nitrogen, in the form of sulphate of ammonia, was given with the base dressing of phosphate and potash. Double dressings of organic matter have not necessarily given better results and the extra dressing has not compensated for the lack of nitrogen.

At times the use of different forms of quick-acting nitrogen has been advocated to push a crop forward or to help in the recovery of one affected by frost or severe wind. From simple trials made under such circumstances, provided a good base fertilizer was applied before planting, there does not appear to be much advantage in applying top dressings of nitrogen to damaged crops, and there are also indications that heavy dressings of more than 10 cwt per acre of quick-acting fertilizer may, in fact, delay the bulking of the crop.

In some conditions the addition of a top dressing of nitrogen to normal crops has been justified. But this is not always so. Trials have been carried out here to compare the application of fairly heavy dressings of nitrogen in the base with the same applied when the plants were just emerging, when they were 2 inches high and with half of the dressings in the base and half as above.

From these it appears that late applications are likely to delay bulking of the crop, and there seems to be no particular advantage in splitting the dressings and applying them before and after planting compared with applying all before planting. Other observations show that, where there is insufficient phosphate in the soil, bulking of the crop may be slow and that, while potash is very necessary, there does not appear to be any need in normal circumstances for very heavy dressings.

In most cases where land has not recently had dung, 20 tons per acre of dung or compost ploughed in is advisable. Wherever possible, it is better to broadcast the fertilizer on the open drills rather than on flat land. If applied by machine, and particularly if heavy dressings are given, damage may occur in dry seasons if the fertilizer is concentrated immediately below the seed. A mixture of sulphate of ammonia 5 cwt, superphosphate 5-6 cwt and sulphate or muriate of potash 2 cwt per acre, would be suitable for many crops. In many cases compounds will be used, and the analysis and ratio will not be quite the same as that of the above mixture. Those having a ratio of 1 N, 1 P_2O_5 and 1¼-1½ K_2O, although having a little more potash than may be necessary in some circumstances, give very good results and can be used at rates of 8-15 cwt per acre, depending on the concentration in the mixture and whether dung has been applied or not.

Varieties

The need for the right varieties properly presented at the market is more important these days than it used to be. A well-shaped kidney variety, of good appearance, easy to scrape, with heavy cropping powers and producing a high proportion of even-sized tubers, has for a long time been considered ideal. Early bulking is very important where the crop is lifted at the rate of about 4 tons per acre and, where there is the possibility of the crop having to be left in longer, the ability to continue increasing in weight is also important. Shortness of stolons for easy lifting of the crop is important and, although much less haulm is produced in areas bordering the coast, haulm that is not too seriously affected by wind is an advantage. Old and new varieties have been under trial for some time at Rosewarne, and some details of the most important kinds are given in the following paragraphs.

ARRAN PILOT is the most widely grown of the early varieties and, although a kidney, is rather irregular in shape and variable in size. When well graded, however, it is equal to Jersey Royal in appearance. Although not quite the earliest to bulk, it is less affected by adverse conditions at planting and, once it starts to bulk up, quickly increases in weight. Stocks are variable; some of the dwarf ones are earlier in bulking, but all tall plants are not necessarily later. The variety is less affected by common scab than some others but seed is rather susceptible to dry rot. Sprouting is rapid and may be difficult to control in mild conditions and in normal storage when planting is delayed.

HOME GUARD, the next most popular variety, is oval and samples are generally more even in appearance than Arran Pilot. It is often a little earlier than that variety, but later on does not continue to bulk at the same rate. This is particularly so when a dry spell occurs during the period of bulking.

ULSTER PREMIER is a quality potato with long kidney to oval tubers, pink at the rose end and near the eyes. Early samples are of good, smooth

appearance. Later on large tubers may be curved and liable to mechanical damage. Some crops now show a high proportion of tubers with little or no colour. In good soils and grown in the right condition it is capable of giving fairly heavy yields earlier than Arran Pilot. Cold and wet conditions at or after planting may give an irregular crop. Seed is liable to dry rot and needs careful handling. The variety is subject to blight and if not dug early tubers may be infected in wet seasons.

ULSTER CHIEFTAIN is a very early oval variety with a dwarf haulm giving rather poor cover and allowing weeds to grow. With the tubers clustered close to the stems it is otherwise easy to lift. It should be dug early or the tubers may become too coarse and also crack. In some conditions it is very susceptible to scab quite early in the season.

ULSTER PRINCE is an early variety with long kidney tubers which are sometimes curved at the base. It is suitable for special conditions and markets and, although at one time it showed considerable promise as an early bulker, in some early areas it has not become very popular. This is partly because of the few tubers produced per plant and partly on account of the need for a high seed rate per acre and the difficulty of producing seed-size tubers. If not lifted early the tubers soon become very large and may be misshapen and split. Sprouting of the seed may be rather shy and irregular. In cold spells early in the season, the low-growing haulms may be very yellow soon after emerging. This condition is sometimes seen to a lesser degree in Arran Pilot and a few other varieties, but generally disappears as the season progresses and conditions improve.

CRAIGS ROYAL is classed as a second early, but in good growing conditions in some seasons it may bulk early and be ready for lifting at the same time as Arran Pilot. The tubers are flat oval, partly coloured with pink. Well-grown clean samples are very attractive in appearance but some crops show a high proportion of tubers without colour. On soils with a high pH the variety is susceptible to common scab, and if left too long in the soil may be affected by blight.

ARRAN COMET, an oval variety, has shown considerable promise in trials carried out in recent years. For three years in succession it has been earlier than Arran Pilot and most other varieties, and has also cropped heavier throughout the season. The tubers are rather like Home Guard in appearance. They are subject to scab in some conditions and it is reported that dry rot can be troublesome in the seed trays. Growth is sturdy but not over-vigorous and is less affected by drought than varieties such as Home Guard.

PENTLAND BEAUTY, a blight-resistant variety with bright red splashes on oval kidney tubers, has been tried for some years and has recently been introduced. The early samples are of very good colour but a little uneven in appearance. Bulking is a little slow but good weights are soon produced. If it is not lifted very early and left in for some time, the tubers show a high but not complete resistance to blight. The haulm is rather similar to Home Guard.

SUTTON'S FOREMOST, introduced in recent years, produces thick oval tubers in early samples. Later on, the tubers are rather flatter in appearance. This is an early variety but, like some others, it has varied from year to year

in earliness of bulking. The haulm is variable but generally of only medium height.

CRAIG'S ALLIANCE, a thick oval variety of even-shaped appearance, has bulked early on occasions; the ware was then generally rather small. This is a good variety, with rather tall haulm, but it is not consistently early enough for first early markets.

CHANCELLOR, another oval to kidney variety, has been under trial for some years but is not early enough.

Older varieties

Some of the older varieties which are still grown, or have been retried, are worth mentioning.

MAY QUEEN is grown now only in small quantities. In good soils and warm sheltered positions it may crop just a little earlier than Arran Pilot, but under less favourable conditions is no better than that variety for early bulking. The kidney tubers are attractive when young, but a fair proportion of them may become rather misshapen if left to grow very large. Seed must be lifted and treated very carefully, otherwise there may be very severe losses from dry rot.

DUKE OF YORK is found by a few growers to be satisfactory, particularly where a yellow-fleshed variety is required.

JERSEY ROYAL, long grown in Jersey for export, has been tried from time to time. Although it is a very good kidney shape and is easy to lift because the tubers are clustered close to the stem, it has not given outstanding yields in Cornwall.

EPICURE is one of the earliest varieties to bulk, but because of its deep eyes and irregular shape is not much in demand.

ECLIPSE, NINETYFOLD and SHARPES EXPRESS, which were favourites of the past, do not now possess any particular advantages and are seldom grown.

A new stock of DARGILL EARLY has been tried and, although the tubers are very attractive in appearance, the crops are not particularly early.

Others of the old first and second early varieties, and some of the newer main-crop varieties which might possibly be of some use for early lifting, have been tried but so far none of them has been consistently good. New varieties, which combine more of the desirable characters and are suitable for early areas, are still needed from the plant breeders.

Slatted Floor Housing for Cattle

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This article is based on the findings of a Study Group set up by the Technical Committee of the A.L.S., of which Mr. Green is the leader.

THE main object of slatted floors in livestock buildings is to do away with litter (and thus the labour of handling it), and the frequent removal of dung. A slatted floor is made up of parallel bars (slats) of hardwood, concrete or metal so designed that dung and urine will pass between the slats and fall into a collection pit. The widths of the gaps and the slats are specified for different classes of livestock to give maximum comfort to the animals and, at the same time, be self-cleaned by the action of the hoofs of the animals. A smaller floor area is allowed per animal on slatted floors than in other loose housing to ensure self-cleaning of the slats, and no storage space is required for bedding materials such as straw.

Development of slatted floor systems

In Norway cattle have been housed successfully in slatted-floored pens in insulated draught-free buildings over the past ten years, and, on many farms, the cattle are confined to the slats for 9 months each year. The original softwood slats were discarded because of excessive wear, and for the past 7-8 years reinforced concrete slats 5 inches wide, with arrises rounded, set firmly $1\frac{3}{4}$ inches apart, have been preferred. For cows the same slats are used for all classes of animal but are laid closer together for young cattle, pigs and sheep. Dung is collected in a deep cellar below the slatted floor and it has been found necessary to seal the cellar to prevent draughts under the livestock. Adult cattle are allowed 35-45 sq. feet of floor area per head and are usually kept in groups of up to 12 animals. On almost all farms the livestock are hand fed and the dairy cows are milked at one side of the slatted area. Small quantities of sawdust are sprinkled on the slats each day to maintain a dry surface.

A slatted floor made up of narrow oak and elm slats, 3 inches wide and set 2 inches apart, was installed by Mr. G. Yeomans, Hartland Point, North Devon, in 1957 in an enclosed barn in which the dairy herd was housed overnight. By the winter of 1959-60 dairy cattle on some twenty farms in England and Wales were housed in slatted-floored buildings, and in the majority of cases the slat and gap widths were 3 inches and 2 inches respectively. There were single instances of hardwood slats 5, 8 and 10 inches wide and concrete slats 5 inches wide. Cows were kept in groups of 20-100 on slatted floors and on most farms were allowed free access to non-slatted feeding areas.

The number of slatted floors has been rising steadily; there have been changes in the dimensions of slat and gap widths and clearly defined systems of dung removal have been developed.

A more recent development on some farms is a slatted feeding area some 8-10 feet wide along the front of the mangers which has been used in conjunction with a bedded area. It is known that economies in bedding straw result from the use of a solid concrete feeding area which can be cleaned mechanically every day. The use of slats in the feeding area does away with the need for daily cleaning.

Comfort and cleanliness of the cattle

Slatted floors have not been widely adopted for dairy cattle because of the conflicting evidence concerning the health and comfort of animals confined in slatted-floored buildings in this country. Although animals have sustained injuries to legs, hoofs and teats, there have been very few reports of reduced milk yields when cows have been introduced to slats, and there have been no reports of lower liveweight gains in store and fattening cattle.

Dairy cows do not appear to be comfortable on slats, and observations of the behaviour of cows on slatted floors and in strawed yards at the N.I.R.D. showed that few cows lie down on the slatted floor in the first forty-eight hours. When wider slats were provided animals preferred to stand on these slats. Many of the cows appeared to be uncomfortable when standing or walking on, and parallel to, narrow slats because a single slat was not wide enough to take a full hoof.

Cows in the strawed yard spent about twice as much time lying down, and they were obviously more comfortable and relaxed than cows on the slatted floor. Two of the cows in the slatted-floored yard remained standing throughout one 24-hour period of observations.

Observations of the behaviour of dairy cows in slatted and strawed yards at the National Institute for Research in Dairying.

MEAN NUMBER OF COWS LYING DOWN

		Slatted floor	*Strawed yard*
No. of cows in yard		20	20
No. of days recorded		42	42
Average number of cows lying down at	5.30 a.m.	7	14
	2.00 p.m.	5	12
	10.00 p.m.	7	15

AVERAGE NUMBER OF HOURS SPENT LYING DOWN

No. of cows lying down recorded every 45 minutes from 5.30 p.m. to 5.30 a.m. once each week	*Group I*	*Group II*	
	Straw	*Slats*	*Straw*
No. of weekly readings	6	5	1
No. of hours spent lying down	9¼	4¾	7¾

HOURS SPENT LYING DOWN IN ONE 24-HOUR PERIOD

	Straw	*Slats*
Average	10¾	5¾
Range	8¼—12¼	0—9⅜

The records of injuries sustained by dairy cows in strawed yards and slatted floors suggest that injuries to teats are more frequent where they are kept on slatted floors, and all injuries when they occur tend to be more serious than in strawed yards. Although the hoofs of cattle on slatted floors have remained

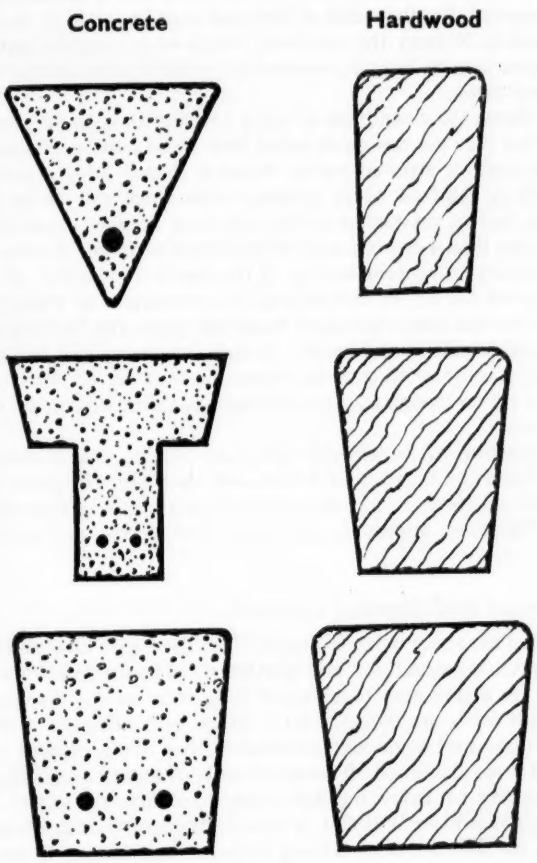

Fig. 1. Typical sections of slats.

hard and not overgrown, pastern and hind leg weakness, and soreness between clays has been observed in cattle on some farms. There is a greater incidence of swollen legs and joints in cattle on slats than in those which have been housed in well-littered yards, but there is probably less evidence of "big knees" than might be expected in cowsheds.

Calves on slats on some farms have shown pastern, leg and hoof weaknesses which may be detrimental for dairy herd replacements.

Leg weaknesses in cattle confined on slatted floors may be associated with badly-laid or worn slats and wide gaps between the slats, and it may be that cattle allowed regular exercise on non-slatted areas would not show these weaknesses. However, this detracts from the objectives of the system, and in Norway and Iceland leg weakness and injuries to teats are extremely rare even

though the cattle are confined in slatted-floored pens for nine months of the year. It is essential that the width of slats and gaps be suited to the size of the livestock, and in Norway the standard 5-inch-wide concrete slats and 1½-inch-wide gaps may be largely responsible for the virtual absence of trouble in adult dairy cattle.

On some farms the cleanliness of dairy cows on slats leaves something to be desired, but they are not more soiled than when housed in inadequately-bedded cowsheds or strawed yards. When a slatted floor is used in conjunction with a self-feed silage system, some cows will lie in the slurry at the silage face in preference to the slats and become excessively soiled. With slats wider than 4 inches a daily sprinkling of sawdust, or some brushing, may be necessary to prevent soiling of the flanks and udders of the cows. Where cattle are fed on the slatted area it is important to avoid spillage of hay or silage on the slats which may block the gaps. The Norwegian type of trough, in which panels of 6-inch × 3-inch steel mesh are laid on top of silage or hay, is most satisfactory in preventing spillage. The various types of hay-rack and raised trough traditionally used in Great Britain are unsuitable on slatted floors.

The combination of 3-inch-wide slats and 2-inch gaps is unsuitable for dairy cows, but a combination of 3-inch-wide slats with 1¼-1½-inch gaps may be satisfactory and farmers who have reduced gap widths to these dimensions claim that the cows appear to be more comfortable and sustain fewer injuries.

Dung removal and disposal systems

The depth of the space below a slatted floor, the length and material of the slats and supporting structures, and whether the slats are fixed or movable is governed by the means and frequency of dung removal and disposal.

Where adult cattle are confined on a slatted area allowing 35-40 sq. feet per animal, dung and urine will accumulate to a depth of 8-10 inches per month, but if urine is drained off the depth will not exceed 8 inches per month. To avoid cleaning out below the slats more than once each winter, the depth below the slats should be 3- 4½ feet. If urine is drained off or sawdust has been sprinkled on the slats the dung is likely to have a dry matter content of more than 15 per cent and can be handled with a tractor and foreloader bucket direct to a muck spreader. Without drainage the dry matter content will be 10-12 per cent and a mobile hopper-spreader with a liquid-tight shutter is required to transport the slurry.

For removal as a liquid by means of a vacuum pump into a mobile distributor tank or an irrigation system water must be added to reduce the dry matter content to about 5 per cent.

The Norwegian buildings on hillside sites provide for a height of not less than 8 feet 6 inches below fixed concrete slats, supported on concrete beams or rolled steel joists running from wall to wall of the building. Doors in one side or end of the building give access to the dung cellar.

On level sites or in existing buildings it may not be possible or economic to raise the slatted floor sufficiently to allow a tractor to be driven underneath, and so, before dung removal begins, some or all of the slats must be removed.

A tractor may be driven on the sub-floor if the distance between rows of fixed supports for the slats is not less than 7 feet. Removal of the floor is

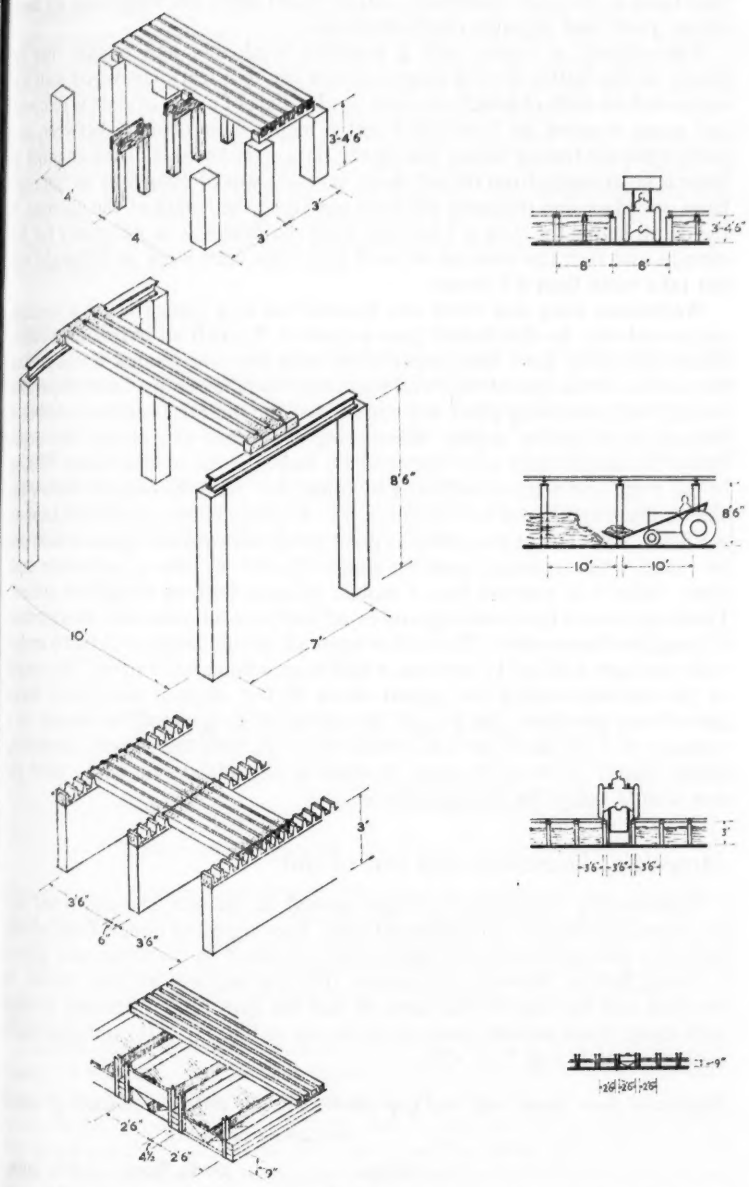

Fig. 2. Slatted floor arrangements with diagrams showing the corresponding methods of dung removal.

facilitated if panels of hardwood slats or metal mesh are supported on fixed corner posts and portable centre supports.

Alternatively, a tractor with a modified foreloader and bucket may be driven on the slatted floor if short movable (up to 4 feet) hardwood slats are supported on walls of 6-inch concrete blocks. Part of a row of slats is removed and dung scooped up from the 3 feet 6 inches wide channel between two walls while the tractor wheels run on the slats on either side of the channel. If there is no drainage from the sub-floor, several loads of dung may be removed from one place and the dung will level out along the length of the channel. If the depth below the slats is 3 feet, no dung removal will be necessary for 2-3 months and then the removal of small quantities each week or fortnight will not take more than 1-2 hours.

Well-mixed dung and water can be removed as a sludge using a vacuum pump and may be distributed from a tank or through an irrigation system. Some difficulties have been experienced with vacuum pumps if silage and hay are fed on the slatted floor and get drawn into the pumps. More expensive mixing and processing plant will ensure that the material can be distributed through an irrigation system. When dung is pumped as a slurry, the depth below the slatted floor need not exceed 9 inches at the lowest point. Mixing of the dung and water is achieved by filling the shallow channels below the slatted floor with water to a depth of 4 to 6 inches before cattle are kept on the floor. The ends of the channels must be closed by sluice gates which can be raised when necessary and the sludge floated off into a collection tank from which it is pumped into a mobile vacuum tank or irrigation system. Fixed concrete or hardwood slats on dwarf walls are suitable when this method of dung handling is used. The shallow channels should be about 2 feet 6 inches wide and have a fall of $1\frac{1}{2}$ per cent, which is approximately 1 in 66. The length of the channels should not exceed about 40 feet without additional sluice gates being provided. The size of the collecting tank should be based on a capacity of 2 cu. yards per cow, which will cope with the effluent (including added water) of about 20 days. If water is not added one cubic yard per cow should suffice for the same period.

Materials, dimensions and cost of slats

Considerable experience has been gained in the use of reinforced and pre-stressed concrete and hardwood slats. The suggested dimensions of slats and gaps between slats in the table below are based on the experience gained in Great Britain, Norway and Iceland. The top edges of all slats should be rounded and the slats should taper so that the gaps do not become blocked with dung. Some suitable sections are shown in Fig. 1 (p. 471) and alternative arrangements in Fig. 2 (p. 473).

Suggested floor areas, slat and gap dimensions for different classes of cattle

	AGE GROUP OF CATTLE			
	Calves		Young Stock	Adult Cattle
	Up to 6 months	6-12 months	12-24 months	over 24 months
Floor area per animal	6-12 sq. ft	15-20 sq. ft	20-30 sq. ft	35-45 sq. ft
Slat width	3 in.	3 in.	3-5 in.	3-5 in.
Gap width	$\frac{1}{2}$-$\frac{3}{4}$ in.	$\frac{3}{4}$-1 in.	1-1$\frac{1}{4}$ in.	1$\frac{1}{4}$-1$\frac{1}{2}$ in.

Concrete slats are usually drier and less slippery than hardwood slats and are most suitable for fixed floors. Well-seasoned oak, elm and keruing, which is straight grained and knot free, can be used in making separate slats or panels of slats for fixed or movable floors. Slats must be held firmly in place and the gaps between slats kept to a constant width.

There are many variables involved in determining the cost of a slatted floor, and until standard specifications are available reliable costs cannot be calculated. Information from farms in England and Wales suggests that where 35-45 sq. feet of floor is allowed per cow, the cost of hardwood or concrete slats with supports and a concrete sub-floor should be in the order of £15-25 per cow.

Future developments

Efforts are being made to produce slatted floors which are more comfortable for cattle to lie on and provide a better foothold for animals rising and walking. The application of surface treatments to concrete and wooden slats may be beneficial, but it is possible that steel mesh or expanded metal, with or without a resilient covering of rubber or plastic, may prove to be more comfortable to cattle and be completely self-cleaning.

The problems associated with the self-feeding of silage may be solved by making and feeding silage on a slatted floor.

Farm Planning in Practice

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"There's nowt like seeing for thi'sen", say Yorkshire farmers.

FARMERS are becoming increasingly interested in demonstrations designed to place emphasis on business management, planning and records. This is shown by a series of farm walks in the North Riding, which were attended by over 300 farmers. Three farms were involved (a small one, a large one and an upland one), and in each case the full data were presented to the visitor.

The first example concerns a farm of 43 acres which had recently changed hands. In the past a traditional mixed farming system had been practised. Four of the fields, totalling approximately 15 acres, followed a four-course rotation; the rest of the farm, 28 acres, was in long leys and permanent grass. The stock consisted of a small dairy herd, rearing cattle and some pigs and poultry. The buildings were adequate, with standing for 17 cattle, four loose boxes and a covered midden. There was also a three-bay pole barn, a stone barn with granary above, and several timber implement sheds. The soil is a medium heavy loam overlying clay. The labour consisted of the farmer with regular assistance from two casual workers.

On the basis of this cropping and stocking, the farm was considered eligible for the Small Farmer Scheme, and on the purchase of the farm a plan was drawn up for the new owner.

New plan for a small farm

The 43 acres were divided into ten fields, all of which were adequately drained, but water supply was a problem. It was because of the distance to the nearest water supply that only four fields followed an arable rotation and with constant arable cropping, the soil structure had deteriorated, giving only moderate yields of cereals. Much of the grassland acreage was unproductive since the leys were worn out, and although all the fields were well supplied with lime, both phosphate and potash were deficient.

The buildings were capable of being used for most types of stock, and therefore decisions on improvements, depending on the system evolved, could be left until a later date; although sufficient capital was available to stock the farm, any developments had to be capable of yielding a satisfactory return on the capital outlay.

It is difficult to get suitable labour in this district because of the counter-attraction of urban industry. The new owner, who had other interests, engaged a young man as manager—a man who had previous experience with a good Friesian herd—and it was obvious that full use should be made of his knowledge and ability. He had little interest in pigs and poultry, which are normally part of the small farm economy. In these circumstances it was decided that an intensive system of dairy farming was the most suitable. By specializing in this way, it was foreseeable that the system could be operated by one man and that fixed costs could be minimized.

The major cost in intensive milk production, particularly on a small farm, is for feedingstuffs. If this cost is to be kept at a reasonable level the greatest possible use must be made of home-produced food. To achieve this, grassland production had to be increased, so the arable fields were sown down as quickly as possible, two of the fields being sown with Italian ryegrass and the other two with timothy-meadow fescue leys, and a piped water supply installed. The best way of improving the existing grassland was by ploughing, cropping and reseeding, but one permanent grass field was kept as an insurance against poaching in very wet weather, output from this pasture being increased by surface cultivation and suitable fertilizer treatments. Two successive crops of potatoes followed the ploughing of an old ley and, where possible, the potatoes were lifted early and a catch-crop of rape sown. Three of the old grass fields have now been ploughed out and the first of these is sown with a ley.

Until all the fields have been improved, the maximum stocking will not be achieved, but at the present time there are already 17 Friesian cows and 18 followers. Because of the interest of the manager in pedigree breeding, replacements are to be reared. Initially, heifers were purchased and every effort made to obtain animals with a high potential for milk production. Records to date prove that this has been worth while. Last year the cows gave an average yield of 1,150 gallons at 3·98 per cent butterfat, and the heifers approximately 1,000 gallons. Concentrates are used, provided a useful return is obtained, but the amount of concentrates fed is strictly rationed according to yield and each cow's food is weighed before feeding.

Haymaking was too much for one man to handle, particularly since heavy dressings of artificial fertilizers had been used. A silo barn has now been constructed and silage-making has enabled better use to be made of the grassland. An area between the cowhouse and the covered midden has been covered, allowing the cows to be loose housed, while the silo barn has been sited so that it will be possible to practise self-feeding.

Summarizing the progress to date, a system of farming has been achieved which is suited to the farm and which makes the best use of the farmer's skills. By specializing, the overhead costs have been kept to a minimum and the work has been made less fatiguing. Unnecessary work has been cut out so the farmer has time available to keep the essential records of performance. By doing so there is little wastage and any weakness is quickly noticed and corrected.

The large farm

It was in 1955 that the foundation of the present farming policy was made. At this time the farm comprised 200 acres of crops and grass, 130 acres of reclaimed moorland and 250 acres of rough grazing. Extensive reclamation had been carried out previously, miles of fencing erected and a water supply provided. Cereals were the main crop, and the production of grass meal from the reseeded areas had been a useful source of income until the early 1950s. The grassland and the rough grazings were utilized by a herd of about 60 Galloway × Cows producing suckler calves for sale, while lambs were bought in the autumn for fattening. The major livestock enterprise, however, was bacon from the progeny of 35 sows. The labour force consisted of six men and the manager. But this system of farming did not yield as good a return as had been obtained previously, and an analysis of the farm business was made. Good financial and physical records were available, enabling an accurate assessment of the position to be made, and it was obvious that while the cereal and pig enterprises were profitable, the returns from the considerable acreage of grassland were poor.

One solution would have been to increase the acreage of cereals, but on this farm much of the acreage devoted to grassland is not suitable for arable cropping, and the yields of cereals on the reclaimed areas where cropping was possible were only maintained by the ley system. The pig housing was fully utilized and the farmer did not wish to lay out more capital to provide additional farrowing and fattening accommodation. The only solution, therefore, was to try to increase the profitability of the grassland. The stocking rate was low and the analysis showed that the output from each animal unit in the cattle and sheep enterprises was below average. To get a higher output, the cows were increased to approximately 70 and an Angus bull was introduced to produce heavier calves in the autumn. The sheep were also increased by establishing a breeding flock of Mule (Blackface × Border Leicester) ewes, a Suffolk ram being used and the lambs fattened in summer. These lambs found a ready market in the district and were sold dead weight.

Although the analysis had shown that the pig enterprise was profitable, a difficulty arose when a bacterial infection was discovered in the sows. To overcome this an outdoor system of pig management was tried. A small number of Wessex × Landrace gilts was bought and housed in cheap

corrugated iron shelters. The gilts were in pig to a Landrace boar and the initial results were encouraging, the records showing the system to be profitable. Good litter averages and good weaning weights were obtained and it was decided to discontinue fattening and to start selling weaners. Outdoor pig keeping fitted well into the farming system and has helped to increase the output from grassland. Labour requirements are low, the sows being fed on cubes which are spread in the field by a tractor-drawn hopper. Water is provided by plastic piping and drinking bowls, and bulk creep feeders are available for the young pigs.

A tenanted farm, which had been purchased some years previously, became available in 1958 and it was then possible to increase the cereal acreage. Of the croppable area, 240 acres was divided into 40-acre blocks with a rotation of three years ley and three years cereals. In the last year of the ley 100-120 sows are kept on the 40 acres for two farrowings; the sows, when dry, being kept on the rough grazing. The extra buildings which became available allowed the suckler calves to be finished, so further increasing the output from cattle.

At the present time there are 200 acres of cereals, 120 acres of ley and 130 acres of reclaimed land which is reseeded when necessary following a forage crop of kale.

There are 55-60 beef calves (all the calves being fattened at 12-15 months), 230 ewes producing fat lambs and 100-120 breeding sows.

This large increase in output has been obtained without increasing the labour force. One man is responsible for pigs, and techniques such as self-feeding the cows in winter and bulk handling the grain have been introduced. By these means the profitability has been increased but the records are still constantly checked so that any wastage or weakness that might appear in the new system can be dealt with immediately.

The upland farm

In 1955 the tenancy of two upland farms was acquired by a young man already farming intensively a 90-acre lowland farm and who wished to expand his business. Both these farms were very much run down and the buildings were practically derelict. One of the farms, with 80 acres of inside land, had moor rights for 400 ewes, but the other farm, of 100 acres of inside land, had no moor rights. Previously these farms, in addition to the hill sheep, had carried approximately only 30 store cattle. Much of the land was wet and covered with rushes and some 50 acres had been completely neglected.

The farmer had always had an ambition to produce beef and sheep, and was certain that the new farms had a much higher potential than had been evident in the past. In spite of the high cost of the necessary improvements, it was decided, with assistance from the Hill Farming Scheme, to embark on a system of intensive management of hill cows.

Between 1955 and 1959, 116 acres were reclaimed, leaving 22 acres of rough grazing and 44 acres of permanent grass. Each year a proportion was drained with a skeleton drainage system, ploughed and cropped with oats. The oats were cut for silage and the area then reseeded. In some fields two pioneer crops were taken before reseeding. As the land was improved, more hill cows were bought, building up to 63 in 1960. In-calf Irish heifers were purchased and subsequently these have been crossed with a Hereford

bull. At first the cows were calved in spring, but it was soon obvious that, if a good price was to be obtained for the suckled calves in autumn, earlier calving was necessary. Some form of housing would therefore be required and this would have a further advantage, since considerable damage occurred when the cows were outwintered on the reseeded areas.

On one of the farms there were tyings for 13 cows, and some loose boxes and a cattle shed for 20 cows was erected nearby. A second shed was constructed in a 2-acre field situated approximately at the centre of the inside land. This provided housing for 30 cows with an adjoining silo barn.

The cows now calve in December/January, usually outdoors, and shortly afterwards are housed. In the 30-cow shed the cows self-feed the silage and approximately 5 tons per cow is carted to the remainder. Silage comprises the main diet of the cows from January until they are turned out in April, but 4 lb per head per day of concentrates is fed from the end of February to turn-out time. The calves have access through a creep feed to a cheap concentrate mixture and a little hay. That this small outlay is well repaid is apparent in the quality of the calves and the price obtained. With this method of feeding no difficulty has been experienced in getting the cows to take the bull and 100 per cent calving has been achieved. An interesting development is that some of the cows are double suckled. Initially these were the cows which calved late and when the grassland was sufficiently nutritious and plentiful to provide milk for two calves. As the calving date has been brought forward, however, these cows have continued to double suckle. During the winter they are tied in the 13-stall cowhouse and the calves allowed to suckle twice daily. Double suckling cows receive 7 lb of concentrates in addition to silage in winter. Suckling continues in spring and summer but the calves are not turned out. Both cows and calves receive a small amount of concentrates throughout. The calves, weighing approximately 6 cwt each, are sold in autumn for very satisfactory prices. There are now 53 single suckling cows and 13 double suckling.

The inside land also carries approximately 70 top draft ewes from the hill flock. These are crossed with a Bluefaced Leicester ram, and the gimmers produced are sold as breeding sheep and the wethers fattened.

The hill flock of 376 Blackface ewes and 100 gimmers is brought down to lamb on the 44 acres of permanent grass. The ewes with single lambs return to the moor one day after lambing but ewes with twins remain until the lambs are strong enough to go to the moor. A 100 per cent lambing average has been achieved but emphasis is placed on feeding the ewes concentrates, starting about eight weeks before lambing. The wether lambs from the hill flock are fattened on the reseeded leys and are sold by the end of October. In addition there have always been some surplus gimmer lambs for sale as breeding stock.

The stocking rate shows that the grassland management is good and, combined with almost complete self-sufficiency, satisfactory returns have been made. The important feature is that a high output has been obtained not only by the high stocking rate but also by producing high quality calves and lambs.

As with the other farms, records are kept of the physical and economic performance, and changes will be made if the records show the necessity.

Mechanized Feeding of Maize Silage

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This article is an interesting sequel to Mr. Mortimer's account of the College trials in 1959-60. Maize silage is a good feed for beef animals, but what should be the economic level of that feeding?

MAIZE for silage has been grown successfully on a farm scale at Harper Adams Agricultural College during the past two seasons[1]. In 1959, harvesting was by means of an attachment to a flail-type harvester; in 1960 by means of the rowcrop attachment to a chopper-type harvester. During 1959-60 and 1960-61 feeding trials conducted at the College used maize silage for fattening Hereford cross bullocks. In the earlier year's trials, the ration was hand fed, and the results were reported in the October 1960 issue of *Agriculture*.[2] But last winter feeding was mechanized to a press-button stage by the use of a tower silo, mechanical unloader, and auger.[3]

The cattle used in the 1960-61 trials were 38 Hereford × Friesian and Hereford × Welsh Black steers, bought as stores in October, 1960, from West-Midland markets. The Hereford × Welsh Blacks were lighter animals, averaging 8 cwt at an average cost of £60 6*s*. per head; the Hereford × Friesians heavier at 9 cwt, averaging £66 per head.

All the cattle went directly into the yard and were fed a ration of 40 lb grass silage, 10 lb pea straw and 3 lb home-mixed ration per head per day. The pea straw was gradually reduced, and grass silage increased, up to 24th November, 1960, when maize silage feeding began. This was fed at 80 lb per head per day, and the concentrates (S.E. 63·54 and 14·84 crude protein) increased to 4 lb per head per day. Before this two bullocks were removed for veterinary reasons and did not proceed to the maize feeding trial. (They subsequently recovered, and were fattened and sold later in the season.)

Silage analysis

A typical analysis of the silage taken in early November just before feeding began was:

TABLE 1

Analysis of maize silage, early November, 1960

	As received per cent	On dry matter per cent
Water	84·6	—
Oil	0·2	1·2
Protein	2·0	13·0
Fibre	4·2	27·5
Ash	—	7·8
Calculated P.E.	1·3	8·3
Calculated S.E.	8·2	53·4
pH value	5·0	—

Analyses during the seasons showed more variation than in 1959-60, and the increased dry matter would be expected from the use of the tower silo.

By early January the moisture content had dropped to 81·9 per cent and in mid-February it had dropped further to 76·7 per cent. The protein was then 2·95 per cent, equivalent to 12·5 per cent on a dry-matter basis. This figure is higher than that of the previous year and resulted in a S.E./P.E. ratio of 6:1, which is narrower than the 10:1 normally given in feeding standards. The difference may be due partly to the use of tower silos, since the harvesting dates and cultural practice for the crop were similar in both years. The finer chop in 1960-61, resulting from the use of the chopper-type harvester, may also have had some effect, since it resulted in better consolidation because of the finer state of the material. The resultant reduction in air space would have a beneficial effect on the fermentation process.

Were the gains economic?

The liveweight gains for the 36 animals on the above ration were:

TABLE 2

Daily liveweight gains of 36 Hereford cross bullocks on maize silage and supplement, 14th Dec. 1960—25th Jan. 1961

Average weight (at 14-day intervals)	Increase	Daily increase (per head)	Range of daily gain or loss (per head)
lb	lb	lb	lb
1030·8	—	—	—
1072·6	41·8	2·99	−2·6 to +7·0
1106·3	33·7	2·41	−0·8 to +4·7
1137·4	31·1	2·22	−0·4 to +4·6

Total increase: 106·6 lb
Average daily increase per head: 2·54 lb
Range of liveweight gain + 1·1 to 4·5 per head per day

The main trial ended on 25th January and lots were drawn for sale from 27th January onwards. The results in terms of liveweight gain per day—approximately 2½ lb per head—were similar to those in the previous season. Fourteen of the lightest animals, mainly Hereford × Welsh Blacks, were carried on for a small-scale trial to determine the effect of increasing the rate of concentrate feeding from 4 to 8 lb per head per day. The results of this are given in Tables 3 and 3A, and 4 and 4A. The former concern the cattle on 4 lb per head per day, the latter those on 8lb per head per day.

TABLE 3

Daily liveweight gains of 7 Hereford cross bullocks on maize silage and supplement, 14th Dec. 1960—15th Feb. 1961

Average weight (at 14-day intervals)	Increase	Daily increase (per head)	Range of daily gain or loss (per head)
lb	lb	lb	lb
936·3	—	—	—
990·7	54·4	3·89	+2·8 to +7·0
1022·1	31·4	2.24	+0·5 to +4·6
1057·1	35·0	2·50	+1·7 to +3·9
1090·3	33·2	2·37	+0·7 to +4·1
1104·9	14·6	2·09	−1·4 to +3·9

Total increase: 168·6 lb
Average daily increase per head: 2.68 lb
Range of liveweight gain +1·86 to +4·13 lb per head per day

TABLE 3A

Daily liveweight gains of above 7 Hereford cross bullocks on maize silage and low concentrate level, 15th Feb.—19th April 1961

Average weight (at 14-day intervals)	Increase	Daily increase (per head)	Range of daily gain or loss (per head)
lb	lb	lb	lb
1104·9	—	—	—
1113·9	9·0	0·4	−2·3 to +1·2
1126·0	12·1	0·9	−1·1 to +2·1
1158·7	32·7	2·3	+1·0 to +3·7
1193·4	34·7	2·5	+1·2 to +4·7

Total increase: 88·5 lb
Average daily increase per head: 1·4 lb
Range of liveweight gain: +0·62 to +2·02 per head per day

TABLE 4

Daily liveweight gains of 7 Hereford cross bullocks on maize silage and supplement, 14th Dec. 1960—15th Feb. 1961.

Average weight (at 14-day intervals)	Increase	Daily increase (per head)	Range of daily gain or loss (per head)
lb	lb	lb	lb
980·4	—	—	—
1015·7	35·3	2·52	+1·3 to +3·6
1049·7	34·0	2·43	+1·5 to +3·1
	(one animal in group ill not weighted)		
1103·9	54·2	1·94	+1·4 to +2·7
1125·5	21·6	3·09	+1·9 to +4·0

Total increase: 145·1 lb
Average daily increase per head: 2·3 lb
Range of liveweight gain: +1·90 to 2·68 per head per day

TABLE 4A

Daily liveweight gains of above 7 Hereford cross bullocks on maize silage and high concentrate level, 15th Feb.—19th April 1961

Average weight (at 14-day intervals)	Increase	Daily increase (per head)	Range of daily gain or loss (per head)
lb	lb	lb	lb
1125·5	—	—	—
1162·1	36·6	1·74	+0·7 to +2·5
1190·1	28·0	2·00	+1·1 to +3·0
1212·9	22·8	1·63	+0·6 to +3·0
1246·7	33·8	2·41	+1·6 to +3·4

Total increase: 121·2 lb
Average daily increase per head: 1.92 lb
Range of liveweight gain: +1·44 to +2·29 per head per day

In both cases the animals were making satisfactory gains of 2·68 and 2·30 lb per day respectively (Tables 3 and 4) before going on to the trial ration. Both groups gave poorer average performances of 1·40 and 1·92 lb respectively on the trial (Tables 3A and 4A). The overall lower liveweight gains, and consequently poorer conversion figures may be accounted for partly by the increased weight of the animals as the trial progressed. The comparative figures are, however, the important ones, and on this evidence the value of the extra liveweight gains of 0·52 lb per day at an approximate value of 9*d*., is

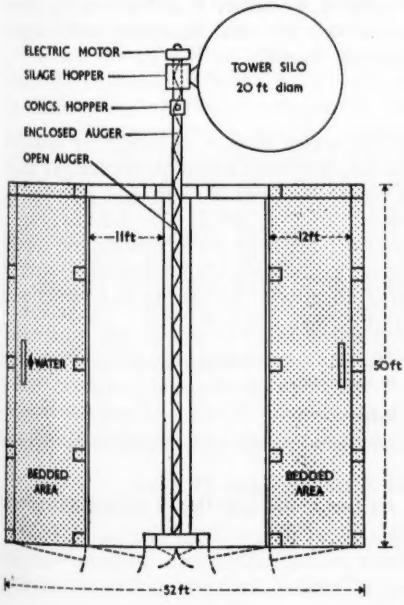
less than the cost of the extra 4 lb of meal, which at £30 per ton amounts to 1*s.* 1*d.* Thus the higher feeding rates were uneconomic. However, further trials would be needed to confirm these preliminary findings, but they do suggest that the basic ration of 80 lb maize silage (£2 per ton) and 4 lb concentrate (£30 per ton) costing 2*s.* 6*d.* per day is about right for the type of animal. In both seasons the approximately 2½ lb liveweight gain per day has been obtained at a food cost of one shilling per lb.

Seven of the animals from the 1960-61 trials were sold through the F.M.C. at an average price of £84. Carcass evaluation, and gradings were again satisfactory. However, the majority were sold through the auction ring, with an overall average price of £90 8*s.* 5*d.* (The chance nature of the auction ring was seen during a foot-and-mouth period when 14 animals averaged £96 13*s.* 7*d.*, about £10 a head higher than a lot sold the previous week.) All except three of the animals graded "A", and there were no adverse comments on carcass quality or fat colour from the silage feeding.

Mechanical feeding

The layout of mechanical feeding arrangements at the College is shown in the diagram below. This gives the relationship of the 20 ft diameter by 40 ft high 300-ton tower silo constructed with 2 ft 6 in. × 2½ in. tongued-and-grooved concrete staves with wire rope banding, to the 52 ft by 50 ft covered cattle yard with its central auger, designed to fatten 38 cattle at a time.

Filling the silo with material harvested by means of a chopper-type forage harvester was undertaken with a P.T.O.-driven forage blower. Mechanical unloading wagons were used to convey the chopped material from the field to the silo.



Unloading the silage is by a top unloader, driven by a 7 h.p. motor, which is suspended just above the surface of the silage by three-point suspension steel cables. A single auger rotates around the silo and conveys the silage to a central blower, which discharges the material by means of a spout through a series of openings running down one side of the silo. These openings lead into a chute down the outside of the silo, and this directs the silage into a hopper above a 7½-inch auger. The auger is driven by a 3 h.p. motor, and the drive from this is used to operate the concentrate feed hopper mechanism. (For larger units a bulk store for the concentrates, with a small auger to feed into the hopper

could be used, but with the College unit the small hopper is sufficient for the concentrate used at one feed.)

The finely-chopped silage and concentrate is mixed in the enclosed part of the auger, before it is conveyed to the open auger in the cattle yard. This mixing of silage and concentrate is an essential feature of the College system.

The amount of feed per head of stock is controlled by adjusting the height of the auger above the boarded floor of the manger. On a commercial scale only the auger and floor is needed, but at the College manger divisions and individual ties have been installed to allow other feeding trials to be conducted in the same yard.

There is an 11 ft-wide area on either side of the manger, kept clear of muck by a tractor squeegee. On the outside is a straw-bedded area, separated from the unstrawed by a 12 in.-high brick wall, and the animals lie back on this and then come forward for feeding. This system of bedding has operated very successfully and has reduced straw requirements to 7 lb per head per day, that is, to less than half of that normally needed.

Feeding the daily ration of 80 lb maize and 4 lb supplement takes 10 minutes each night and morning. This allows sufficient time for the stockman to inspect the cattle and check the water bowls, etc., whilst the machinery is operating.

Costs of equipment

As the equipment used is American, it is difficult to discuss costs of this experimental set-up at this stage. But they are high, since they have to cover higher U.S.A. cost of production, freight charge and import duties. At present, unloaders cost in the region of £400-500 and augers around £3 per foot. These prices should be reduced, however, if manufacturing takes place in this country. Concrete stave tower silo costs should be in the region of £1,000 for 300 tons, i.e., £3-4 per ton stored.

Summary

The results of the trials indicate that maize silage is an extremely valuable and palatable feed for beef production, and that economic liveweight gains of 2½ lb per day at a feed cost of one shilling per lb liveweight gain can be obtained from feeding it in amounts up to 80 lb per day for 8-10 cwt cattle. The rate of concentrate feeding above 4 lb per head per day would not appear to be economic at present. Maize silage easily fits into a mechanical system of feeding, but it can also be utilized effectively by the more conventional methods of feeding from trench and surface silos.

I am grateful to the Principal, Mr. W. T. Price, and colleagues in the Farm Department for their encouragement and assistance in the trials.

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Whither the Farm Orchard?

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The old concept of the farm orchard has changed, but it may still be a source of profit if confined to the right kinds of fruit and properly looked after.

THE farm orchard could be found in England wherever the soil was considered suitable for fruit growing. It still exists in every stage—from flourishing health to the old decayed stumps of a few trees. It has played its part in the life of the community which makes up a farm. The farm orchard was likewise a feature of American farming, and many of the farmers along the eastern seaboard followed the same pattern—that of planting a small field or paddock with fruit trees to supply the needs of the farmer and his family. Some remnants still remain, but the deterioration there has been quicker than in England. Briefly, the farm orchard served first to supply the needs of the farmer and his family in fruit and then, in some areas, in cider apples and perry pears. The growth of the latter was a very local feature restricted to the western and south-western counties, where the cider and perry was made and used mainly on the farm—a recognized perquisite of the farm workers. Although the cider provided for this purpose was diluted in various amounts and should more correctly be called "cider cup", the trees in the orchard supplied the basic needs for the making of the cider. The orchard was also a very useful area for running poultry, a sick-bay for ailing animals, or for stock which needed to be segregated from the main herd: it also provided a warm, sheltered spot for lambing.

But how does the farm orchard fit into modern farming practice? Where the soil is especially suitable, as in parts of Kent, the farm orchard has long ago been extended, both in area and in range of fruits, to give the familiar mixed orchards of apples, cherries, plums and pears found in some of the older fruit areas, as around Sittingbourne. In this way the orchards have grown out of their original purpose as simply farm orchards. In the past, dessert and culinary varieties of apples and pears were used at home and any surplus was sold locally. This still applies in some areas, where a particular orchard is known for certain esteemed varieties. The farmer of one orchard in Cornwall which grows the apple Yellow Ingestrie has little trouble in disposing of all his crop locally, and there are others elsewhere, but these are exceptions. The sale of produce of this type in the wholesale market is slow and not very profitable to the producer. Were it to be costed, the farmer would often find it would have paid him to have left the fruit in the orchard. With the changing methods of retail sale, the disposal of ungraded fruit from unsprayed orchards will become less and less remunerative.

Value of right kind of fruit

The kind of fruit has a bearing on the sale. The odd cherry trees, which may still be found in farm orchards, are rarely picked because the labour for bird-minding when the fruit is ripening is either not available or would be

too costly to employ. Cherries need to be planted in a unit sufficiently large to employ a minder when needed, and 4-5 acres seem to be about the minimum that should be planted.

Plums are a doubtful proposition in farm orchards today. The standard of cultivation would tend to produce full crops only when other fruit growers have full crops and prices are therefore low, and in any case the best quality crops are not grown on a grazed sward.

Dessert pears are still a feature of many farm orchards. The trees are usually old and, unless adequately sprayed, the fruit tends to be scabby. Markets are becoming more selective in their acceptance of varieties, and the lesser-known kinds make less money compared with the better-known varieties such as Conference, Williams' Bon Chrétien and Doyenné de Comice. Some existing pear trees may well produce a little cash but there seems to be little future for fresh plantings. Inevitably, they would need to be on pear stock to produce big enough trees to allow grazing; such trees are slow to come into bearing, probably too slow nowadays, and too costly to spray.

It is doubtful whether dessert apples grown in farm orchards would compete in modern markets with those grown in the more conventional way. There may be some years when the sample would be of such quality as to hold its own, but in most cases the fruits would be too small and too scabby.

For some years culinary apples from farm orchards, especially Bramley's Seedling, Newton Wonder and Annie Elizabeth, have found a ready sale in certain markets; and some orchards, which have been sprayed sufficiently well to produce good quality fruit, still provide a useful profit to the farmer. Often this fruit is bought by dealers who may well have refrigerated storage at their disposal, and thereby both farmer and dealer are satisfied. Pruning in such cases is not an exacting task and is well within the powers of most farm employees who have been given the necessary instruction.

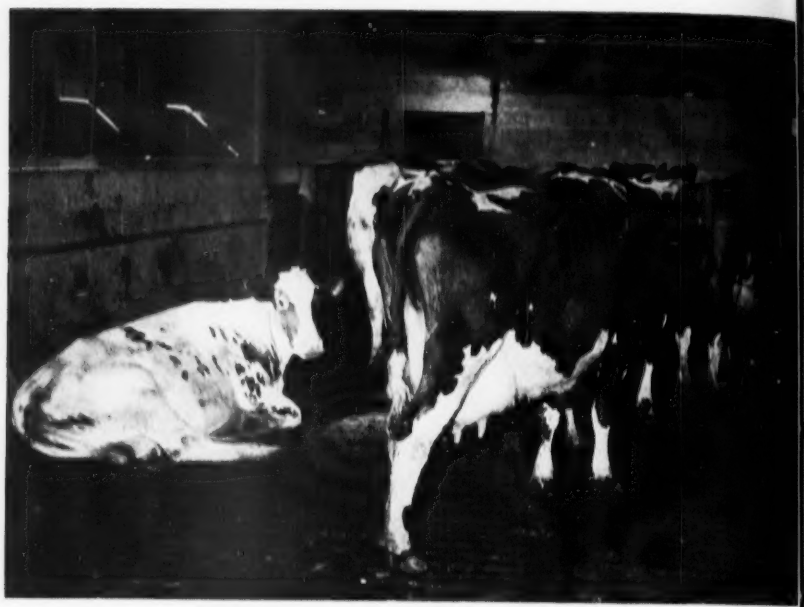
Lastly, there are the two crops of perry pears and cider apples. A recent article in *Agriculture**, written by R. R. Williams, has described the possible trend in planting new orchards of these fruits. There is no doubt that a well-planted and well-grown cider apple orchard is a valuable asset to a farm on which stock or sheep are kept. Five acres is a useful unit and when in full bearing the trees should produce an average crop of 5-6 tons an acre of cider apples. At current prices this means £66 to £72 an acre gross. From this must be deducted the cost of transporting the fruit from the farm to the factory, and £5 to £10 an acre must also be allowed for picking up and bagging. As the farmer has the value of the grazing and the "difficult to assess" amenity value for lambing, possible poultry keeping, and other ventures, this makes the orchard a useful extra enterprise.

But in considering where to plant and where not to plant, we seem to have gone full circle. The original orchards were planted to supply a local need because transport from other areas was not good. Gradually we saw the decline of the orchard as transport between areas improved. But now, with cider apples and perry pears which are a low-value product—£12 to £15 a ton —and with a very marked reduction in the number of cider factories in the country, there is a great need to consider transport costs. These can be a vital factor in the profit or loss of the enterprise. So, as Mr. R. R. Williams has

*WILLIAMS, R. R. (1961). Cider and Perry Fruit Production. *Agriculture*, **68**, 304-6.

Opposite: Fully-grown standard cider apple orchard. Photo: *Bulmer & Co. Ltd.*

Slatted Floor Housing for Cattle (Article on pp. 469-75)



Cows on a wooden slatted floor.

Photos: *Farmers Weekly*

One method of mucking out a slatted floor for cows.

Mechanized Feeding of Maize Silage (Article on pp. 480-4)

Filling the concentrate hopper. The silage hopper is to the left, and the ration is mixed in the enclosed tube before entering the cattle yard.

Photos: *Wellington Journal and Shrewsbury News*

Hereford cross bullocks feeding from the auger manger. The height is adjustable by means of the screw on the top of each bracket.

EVE

The Aberdeen Research Establishment constructed this fully-instrumented Experimental Vacuum Equipment (EVE) pilot plant to help in their investigations into the Accelerated Freeze-Drying process.

pointed out, there is a need for increased plantings of cider apple orchards near enough to the factories to make carriage easy and not too costly—possibly within range of the farm tractor. The argument for perry pears is similar, except that fewer factories are prepared to buy these pears. Therefore, production should be even more restricted to areas within range of a factory.

To sum up, it seems that there would be a future for the cherry orchard of not less than five acres, for culinary apple orchards, and for cider apple and perry pear orchards situated reasonably near to a factory. For culinary apples spraying is a must, and it is also desirable for cherries and cider and perry fruit. Dessert apples and pears are not suitable crops for the farm orchard unless there happens to be a special local market for the fruit.

Existing orchards

Many of the existing orchards need improvement—some are past it—and advantage might as well be taken of grants now available to grub the trees, clear the land, and use it more profitably for other crops. Many tenant farmers are handicapped by agreements which insist on the replanting of any gaps in orchards and the maintenance of the orchard as an orchard. These agreements are not always best for either party. Often it would be better for the landlord to give permission to grub the orchard, and, if replanting is desired, to use a fresh site.

No one answer applies to all orchards, and only general guidance can be given on which course to take. Undoubtedly, the first task is find why the orchard is not thriving. Old and gappy orchards are obvious enough; others, which look healthy in growth, may not crop well, and the reasons must be sought. First then, the old and gappy orchard. Before any decisions are made it should be established by examination whether the root rot fungus *Armillaria mellea** is or is not present. If this is the trouble then the course is clear. Retain the trees until the orchard does not pay, or until the land could be put to more profitable use, then grub them. No replanting should be done for at least ten years after grubbing or preferably longer.

Then there are the orchards not pulling their weight because of the choice of varieties. It may be they are poor-cropping varieties or prone to apple canker; or possibly the selection of varieties in the orchard has not provided for adequate pollination of them all. In all cases a change of some varieties is indicated, and the question is whether to grub and replant with new trees or to graft the old ones. Five or ten years ago advice would have been to graft. But lately it has become very apparent that virus diseases are playing a bigger part in tree fruits than hitherto. Or is it that we are more aware of their presence? Most varieties of cider and culinary apples are infected with virus diseases to a greater or lesser degree, but they may be divided roughly into those varieties which show visible symptoms and those which do not (carrier varieties). The difficulty arises when healthy scions of a variety which shows virus are grafted into a "carrier" of the virus. The grafts quickly become infected and the tree is always a poor one. Generally, if pollinators need introducing and the orchard is young, replanting is the wiser course; if the trees are older, say 20-35 years old, then pollination may be introduced by grafting, but a careful choice of varieties must be made. In cider apples,

*Advisory Leaflet 500 gives details of this disease.

varieties which show little virus symptoms should be chosen, and the more vigorous varieties, such as Bulmer's Norman and Vilberie, are suggested. With culinary apples, Grenadier (an early cooking variety) and Lord Derby (a midseason variety) are slow to show symptoms of virus. Howgate Wonder (maincrop to late), which would fit in well with Bramley's Seedling, might also be used. Generally grafting is no longer looked upon as the cure-all, and needs using with care.

This is the best advice that can be given from what we know at present but, with the advance of knowledge and the availability of more varieties of apples which have been freed of the virus diseases recognized today, other advice may well be given in the future.

Good management

Another cause for unfruitfulness is the incidence of pests and diseases. Pests like caterpillar and aphides, and diseases like silver leaf and apple canker, are obvious. On the other hand, apple sucker is not. The damage is done when the blossoms are small. The immature stages of the sucker puncture many holes in the young flower-stalks and prevent the development of the apple. As a result the flower does not set, and it is often not until then that the farmer sees trouble—too late to apply a remedy that season. Apple scab and pear scab can also be troublesome, providing entry for apple canker as well as reducing the crop in both numbers of apples and size of each fruit. All these points need watching carefully. When the farmer is in doubt advice may be sought from the N.A.A.S.

Manuring of the grazed orchard is, of necessity, a compromise between the requirements of the trees and the grazing animal. In both cases phosphate and potash can be applied to supply the full needs of each without detriment to either. Nitrogen will be a problem in that more will probably be needed for full fruit production than for grazing. However, no harm would generally be done by applying larger quantities than usual. Most farm orchards would benefit by 100-140 units of nitrogen each year, but it should be applied during the period November to January to give full benefit to the trees.

There are various systems of grazing and of utilizing the grass. Two cardinal points should be remembered. Firstly, crops of hay or of silage will only be taken to the detriment of the trees; secondly, the orchard will have an enforced rest from grazing when the boughs bend with the weight of the fruit and when the apples fall. There will therefore be a flush of grass available as soon as the apples are picked up in October or November, which will make useful winter grazing or outwintering, plus the protection of the trees for cattle. This is usually followed by a rest period again until early spring. Poaching should be avoided, though it is often found that the orchard, with its network of roots underground, is less likely to poach than other open fields. Grazing, then, falls into two periods which may not necessarily be continuous—from November to January and from early spring to August.

The new orchard

So much has already been written on how to manage the new orchard that this section is perhaps better devoted to emphasizing the more important

points and referring to the literature which is readily available. Generally, the following points apply to the four kinds of fruits which have been suggested as suitable for planting in farm orchards.

1. Choose a suitable site not too exposed to winds, particularly the cold east and north-easterlies of the spring, and the south-west gales of autumn; and where the frost risk is not excessive.
2. Make sure the soil is suitable in depth, texture and drainage for the fruit to be grown.
3. See that you get good trees and plant them well, making sure of adequate staking and protecting the trees against stock, rabbits and hares. Subsequently, examine the ties and supports each year and loosen or re-tie where needed.
4. Prune to provide a strong initial framework which will stand up to the heavy crops expected. (See "The Training of Apple Trees", *Scientific Horticulture*, 1960.)
5. Provide a suitable mulch around the base of the trees for a radius of 3 feet—and maintain for three years. Straw is the most suitable material, but dung or sawdust is satisfactory.
6. Ensure that pests and diseases are kept down by spraying and other appropriate measures, especially during the early years.

When planting cider apples and perry pears pay special attention to the choice of varieties. Provision must be made for pollination, and varieties chosen which will drop their fruit at about the same time and so free the orchard sooner for stock, which must necessarily be excluded when the fruit is ripening and falling.

Much the same applies to cherries, but pollination is more complex and, as picking takes time, a number of varieties will be needed which will ripen in sequence over a convenient period.

The choice of varieties of culinary apples is governed by time of harvesting, whether they are required for storing or to be sold straight off the tree, pollination, vigour of each variety and the desirability of planting varieties together which have similar tastes of spraying, manuring and possibly pruning too.

All these points have been written about before; many have been illustrated, and advice is readily available to those who seek it and who may wish to have it at home. Yet how often do many of the points of good culture in husbandry go unheeded in the farm orchard!

Further information about the fruits mentioned in this article can be obtained from the Ministry's Bulletins Nos. 104, *Cider Apple Production* (in the press), 119, *Plums and Cherries* (price 6*s.*, by post 6*s.* 6*d.*), and 133, *Apples and Pears* (price 7*s.*, by post 7*s.* 7*d.*). Copies of these publications may be obtained from H.M.S.O. or through any bookseller.

Profitable Milk from 66 Acres

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This story of a small Cheshire farm shows that, with sound planning and efficient management, an adequate income can be achieved on a small acreage.

IN recent years a great deal of thought has been given to the question of the future place, and the profitability, of the small farm in the United Kingdom. In this connection milk production on Mr. D. Boffey's farm at Elm House, Burleydam, Cheshire, is significant. The holding, compact and on a well-drained soil, comprises 66 acres, and Mr. Boffey took over the tenancy in November, 1954. His immediate policy was to buy 24 newly-calved attested cows and heifers so as to utilize fully the 24 cow tyings which were available. The cattle were bought at local auctions and through dealers at an average price of £78 each. They were mainly Friesians, but included some Shorthorns and Shorthorn crosses. With the exception of two first-calf heifers, they were all young cows, most of which had had two or three calves.

Shortly after taking over the farm, the N.A.A.S. was consulted about the cropping and manuring for 1955, and also the long-term farming policy. Three alternative partial budgets were prepared. These budgets compared stocking with 35 cows; stocking with 30 cows and keeping a breeding ewe flock of 15 to 20; and stocking with 30 cows with 10 acres of wheat to be grown each year. In each case it was assumed that cow replacements would be purchased, as it was considered that rearing was not economic on the limited acreage. These partial budgets suggested quite clearly that intensive milk production was likely to be most profitable. Mr. Boffey's previous experience had been mainly with cows, and provided the owner was willing to supply additional accommodation for cows, it was decided to concentrate on milk production alone. Early in 1955 the owner agreed to provide a new double cowshed with 38 tyings. With all replacements bought, the stocking rate would then be $1\frac{3}{4}$ forage acres per cow. It was decided to convert a single cowshed with 19 tyings into piggeries as soon as the new building became available. A small cowshed for 5 cows would remain available. By September, 1955, the new cowshed was ready. Further purchases of cows and heifers were made, and by 31st October, 1955, there were 39 cows and heifers on the farm.

Apart from the livestock policy, the future cropping of the farm was considered early in 1955. Most of the fields were suitable for ploughing and it was decided to concentrate mainly on grass but to grow each year a small acreage of kale. A well-sited silage pit with a capacity of 175-200 tons and a concrete floor was already available, and silage-making was decided upon. Hay would only be made if there was surplus grass and weather conditions looked like being favourable. Hay would also be purchased if necessary.

Leys sown would be of two types—three- to four-year mixtures for general purposes and one- to two-year leys of Italian ryegrass to provide early and late bite. The manurial programme was to be based on a general type of complete fertilizer with a high potash content backed up with nitrogenous

fertilizer as required. An electric fence was bought, and strip grazing practised to give good grassland utilization.

Since 1955, the farming policy has adhered quite closely to that decided on originally except that cow numbers have been increased to a maximum of 43. Herd replacements have always been purchased, and although a few heifer calves have been reared at times, none has ever been brought into the dairy herd. The preference to buy replacements is emphasized by the sale of two home-reared in-calf heifers for £65 each in 1958.

Results achieved

The results to date have been outstanding. Table 1 shows clearly the performance of the dairy herd and the high level of management:

TABLE 1

	1955	*1956*	*1957*	*1958*	*1959*	*1960*
Output per cow (gallons)	1,123	1,030	1,222	1,245	1,161	1,222
Average number of cows	25	36	38	39	40	42
Gallons per feed acre	*	316	398	379	338	377
Lb of concentrates per gallon	2·9	3·02	2·55	2·94	3·49	2·93
Percentage winter milk	*	52	52	49	45	48
Concentrates per cow (cwt)	27	28	29	32·8	36	32

(*Figures not available)

The three important factors of profitable milk production have been combined most successfully. The stocking rate with cows is high (63 per 100 livestock acres in 1960, with only 1·55 forage acres per cow); yield per cow is exceptional, and use of concentrates is at a modest level, bearing in mind the high yield per cow.

TABLE 2

Gross and Net Outputs

	1955	*1956*	*1957*	*1958*	*1959*	*1960*	*Average for north-western dairy farms under 100 acres in 1960*
	£	£	£	£	£	£	£
Gross output per acre	61·8	100·9	138·8	144·8	131·2	130·4	84·8
Cattle and milk output per acre	55·2	89·7	106·8	119·8	109·3	105·1	60·1
Net output per acre	43·5	65·0	84·7	96·6	77·2	73·6	42·1

Gross Margin per Cow and per Acre of Milk Production over Purchased Concentrates

	1957	*1958*	*1959*	*1960*
	£	£	£	£
Milk per cow over concentrates	135	142	124	129
Milk per acre over concentrates	77	82	75	81

The results show clearly that good grassland utilization practices can be very successful on the small farm. Although the farm has been very heavily stocked and the amount of grass, both fresh and conserved, required for maintenance of the cows has been high, the grassland of the farm has also contributed substantially to total milk production.

The method of silage-making is of some interest. Mr. Boffey uses his own tractor and buck-rake, but he also enlists the services of a local contractor who provides four or five men with tractors and buck-rakes to carry the crop quickly to the pit. In this way some 15-20 acres of grass have

been ensiled each year in a very short period, usually towards the end of May. The silage, in consequence, is of good uniform quality.

Over the last five years an average of 12 cows have been replaced per year. This is not unduly high since heifers are rarely bought. Cows which are satisfactory producers and which breed regularly are retained indefinitely. Over the same period, the average price paid for replacements has been £84 per head. In early years, artificial insemination was used but conception rates were found to be none too satisfactory. Early in 1957 a Hereford bull was purchased. He has given first-class results, and in the last three years 87 calves have been sold in all at an average price of £17. This has proved a very useful sideline, since the calves are normally sold at a few days' old.

Other enterprises

Some occupiers have had very good results on small acreages by running large-scale "factory" enterprises of pigs and poultry, involving heavy expenditure on purchased feed. This is by no means the case at Elm House Farm, and although pigs and poultry have made a contribution, milk production is by far the most important enterprise. Some 350 laying hens are now kept in batteries, and replacements are reared from day-old chicks or purchased at one month old. The poultry have generally shown a satisfactory margin over food costs. Pig numbers have not been very high, with usually two or four breeding sows. The progeny, together with purchased stores, are fattened for pork or bacon. The margin over purchased feed has been variable.

Ingredients of success

It is interesting to consider how these results have been achieved.

1. A system of dairying designed to give a high *gross output* per acre has been adopted. Cow numbers have been kept at a high level and all replacements bought.

2. The use of purchased feed by the main enterprise—the dairy herd—has been efficient. Mr. Boffey has been a member of the Cheshire N.A.A.S. Dairy Herd Feed Recording Scheme for five years and has undoubtedly benefited from it.

3. A very high level of cowmanship has been practised, with personal attention to milking and feeding. Without this the high yield per cow would have been impossible. In this connection, Mr. Boffey has been fortunate in having the full-time services of a very good workman from the time the farm was first occupied.

4. Fertilizer usage has been at a fairly high level (approximately £4·5 per acre per year net) over the period, and good grassland utilization practices have ensured a substantial contribution from grass towards total milk production.

5. Great ability has been shown in judging and purchasing high-yielding commercial cows, and Mr. Boffey has proved exceptionally proficient as a dairy farmer.

The figures show that dairying on a small acreage still has prospects, provided output is high enough and costs, particularly of feed, can be kept at a reasonable level.

Improved Brussels Sprouts

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National Institute of Agricultural Botany

Our existing varieties of Brussels sprouts leave room for improvement, particularly in uniformity and trueness to type. Progress in this direction has hitherto been slow, but greater advances are expected from modern breeding techniques.

OF all the vegetable crops Brussels sprouts are probably the most heterogeneous, varieties being collections of plants of different types, some showing more variation than others. There is, therefore, room for considerable improvement in uniformity or trueness to type.

At the present time the sprouts grown in this country are from "straight" varieties maintained by conventional methods of simple selection of the better looking plants for seed production. Under this system improvement is slow and sometimes barely keeps pace with natural degeneration. It is to the newer methods, developed particularly at the National Vegetable Research Station, Wellesbourne, and elsewhere, that we must turn for improvement in the future. This is not to say that there has been no improvement in recent years—there certainly has—but it has been by small steps as compared to the large strides expected from modern breeding techniques.

As an example of what can be expected in uniformity, there are now a few crops about the country of the variety Jade Cross. This is a Japanese F_1 hybrid, and while F_1 hybrid production may not necessarily be the best method for improving the uniformity of this crop, there is no doubt that Jade Cross sets a standard of uniformity never before seen in this country. Unfortunately the variety is not of the type required by most commercial sprout growers here, and it is doubtful whether it will achieve wide popularity. We must now await the production by breeders of new varieties having the uniformity of Jade Cross in the characters required by British sprout growers.

Popularity of dark green Bedfordshire varieties

Bedfordshire has always been one of the most important areas for the production of sprouts. In this county a vigorous-growing type which produces dark green sprouts and is at least midseason, if not late, in time of cropping has for a long time been predominant. Many growers save their own seed and the stocks have been zealously guarded. Despite the fact that so many growers quite independently selected their own plants for seeding, most of the stocks conform closely to this vigorous dark green type.

One or two growers have gone into seed production and have been selling seed for some time now, but it is only recently that seed of this Bedfordshire type of Brussels sprout has been available through the recognized vegetable seed merchants. All stocks are probably of Bedfordshire origin and are obtainable under such names as Ashwell's, Bedford Monarch, Bedfordshire Prize, Blue Vein, Evergreen, King Pin and Market Rearguard, to name but a few.

These varieties have become popular because of the increasing demand in many markets for dark green sprouts. There is no doubt that such sprouts appear to remain fresh much longer than the paler varieties, and the buying public will accept them after they have been in the greengrocer's shop for several days. Pale sprouts kept for a similar time look much less attractive, but whether there is any difference in palatability is questionable. In any case, on being trimmed for the pot, the much-to-be-desired dark green outer leaf finds its way into the dustbin!

Agriculturally, these Bedfordshire type varieties have considerable advantages to the farmer sprout growers, by whom more and more of the crop is grown each year at the expense of the more intensive vegetable growers. Being vigorous in habit they will withstand rough treatment and adverse conditions better than most. They are also rather late maturing and do not seriously clash with labour demands for sugar beet and potato harvesting, which can be substantially cleared before sprout picking starts.

Though yields as high as 8 tons an acre can be obtained from these varieties by heavy feeding (200 lb N balanced by 220 lb K_2O is not uncommon in Bedfordshire), comparative trials have shown that, largely because of their lateness, they are not amongst the highest yielders over the whole season. They will outyield most other varieties after Christmas, but the loss of yield earlier in the season is seldom made up later.

Varieties such as Evesham Special have generally given the highest yields over the whole season, but for markets wanting a dark sprout their paler colour so reduces market price that their yield advantage is generally more than offset in returns to the grower.

Paler varieties suffer by contrast

Evesham, like Bedfordshire, is a traditional sprout-growing district, but all the varieties selected by growers there produce sprouts much paler than the Bedfordshire types, though they are generally earlier maturing. Today Evesham growers find that the price for their pale sprouts from London and Midland markets is so reduced when the dark, but later-maturing, Bedfordshire sprouts come in that they, too, are turning to these varieties for their main crops. Unlike most Bedfordshire growers, however, they grow substantially for the earlier markets, and picking at the end of August is not an uncommon start to their season. For this very early trade growers generally have their own stocks of seed, but varieties such as Early Dwarf and Little Champion, though not particularly good, give very early crops. They are now being challenged by Scandinavian varieties such as Long Island 238 and Early Halftall which appear to be rather better.

For the early, as opposed to very early, trade there have been no recent developments in new varieties, and the old-established ones, such as Ambassador, Triumph, Rous Lench and Cambridge No. 1, are as good as any. All have relatively pale sprouts, and there are still no early-maturing varieties of the colour of the Bedfordshire type.

The recently introduced Irish Elegance has found favour in certain districts but will probably never be grown widely. It has the advantage of extreme sprout smoothness, roundness and solidity, and for a "straight" variety it is very uniform. Against this must be set its pale sprout colour and its need for the best growing conditions. It is less vigorous than the Bedfordshire

varieties, and unless well fed and grown on good, well-drained, land its yield is poor. Yet when well grown its yield can be high, and because of its natural solidity it seldom produces "blowers", however high the feeding.

All the varieties so far mentioned behave very similarly in most districts of Great Britain, and growth habit depends much more on the cultural conditions than on geographical location. Other varieties, such as Cluseed and Premier, appear to behave much more satisfactorily in northern districts than they do further south. These are similar to the Bedfordshire varieties in being vigorous and rather late in maturity, but their sprout colour is markedly paler.

Because of the presence of the disease ring spot (*Mycosphaerella brassicicola*), sprouts can be grown only with difficulty in Cornwall, parts of Devon and and parts of south-west Wales. No varieties have yet been bred which are completely resistant, and until this is done it seems that these districts must remain as the only parts of Britain where sprouts cannot easily be grown for climatic reasons. In all other areas the disease is of such low intensity that, despite the fact that the ordinary varieties are susceptible, no reduction in yield normally occurs.

Though there is a very limited and specialized fresh market for small sprouts of about 1 inch or less diameter, the bulk of the trade is in sprouts of appreciably greater size and all the varieties mentioned give these large sprouts.

Sprouts for quick freezing

Over the last ten years or so increasing quantities of sprouts have been grown for quick freezing. The acreage limit has certainly been reached for the current demand for quick-frozen sprouts but, as so little effort is required to prepare them for cooking at home, the demand could well increase.

For this purpose varieties producing sprouts less than $1\frac{1}{4}$ inches are generally required. The actual size range varies with different quick-freezing companies, but $\frac{3}{4}$ inch—$1\frac{1}{8}$ inches is an average. By far the most widely used variety for quick freezing is Cambridge Special. It produces sprouts of a good dark colour and they are solid and smooth. It is also moderately early maturing, which enables the bulk of the crop to be harvested before Christmas, thus reducing the risk of lower quality and delays in dispatch to the factory because of heavy frost.

In this variety the sprouts are rather close together on the stem, but planting them at spacings of about 24 × 24 inches or less, as opposed to the normal 36 × 36 inches for fresh market sprouts, not only restricts the sprout size to that required but causes some etiolation and improves the spacing on the stem. It is of interest that this variety was bred by Mr. D. Boyes before quick freezing was of any importance, as a variety for the private gardens of connoisseurs who preferred small sprouts.

Other newer varieties are now challenging Cambridge Special but none has yet replaced it. Irish Glacier has its sprouts better spaced on the stem and also "holds" them well without deterioration in quality if left unpicked, but it is rather later maturing and lower yielding. Sanda has sprouts probably darker even than Cambridge Special but it, too, is rather later maturing. Jade Cross is earlier than Cambridge Special, has sprouts of the right size and, because of its remarkable uniformity, is high yielding. Its colour is not as dark as Cambridge Special and it has the disadvantage that the sprouts deteriorate very quickly if left unpicked.

Some quick-freezing companies have, within the last few years, been taking sprouts to the factory "on the stalk". In this method the grower removes all the leaves and cuts the stalk off just below the lowest sprouts. At the factory the sprouts are cut—not picked—from the stalk and can go straight into the freezing line. This saves one handling, for all the sprouts formerly picked in the field had to be hand trimmed at the factory. It is also convenient for the grower who may have difficulty in getting enough labour to pick his sprouts.

For this method of handling the crop, varieties are required which have the sprouts well spaced on the stem and hold well, like Irish Glacier. They should also have the yield, earliness and colour of Cambridge Special. So far no perfect variety has been found, but Cambridge Special is used for this method as well as for normal picking. The holding ability is specially important, as the time of harvesting the stalk is essentially a compromise between the lower sprouts being over-mature and the upper being immature. Uniformity of maturity can be improved by pinching out the growing point. This encourages the upper sprouts to develop more quickly, but with the existing varieties does not completely meet the factory requirement of a long stalk with sprouts the whole of its length, all fit for quick freezing.

Whether it be for harvesting on the stalk, for quick freezing or for supplying large dark sprouts throughout the whole picking season, none of our existing varieties is perfect. Breeding and selection have brought them nearer to the types required, and there are now varieties suitable for the purposes of most commercial growers. It is mainly in uniformity that varieties need further improvement, for everyone would be happy if all the plants in any crop were as good as the best.

Jade Cross shows what can be done with modern techniques, and sprout growers must hope that the breeders and the seed merchants will not be too long in producing varieties uniformly of the required type.

NATIONAL POWER FARMING CONFERENCE

The Eleventh National Power Farming Conference will be held in the Royal Hall, Harrogate, Yorkshire, on 6, 7 and 8 February, 1962. The theme will be "The Next Ten Years", and eighteen internationally-known experts will describe developments in all aspects of agricultural mechanization. There will also be the opportunity of discussing in open forum and in informal groups individual problems which confront both large- and small-scale farmers.

Enquiries regarding tickets (which are free), hotel reservations, etc., should be addressed to The Organizer, National Power Farming Conference, Dorset House, Stamford Street, London, S.E.1.

Steerage Fins for Close Hoeing

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An idea for more accurate and faster hoeing, which also saves labour.

DEVELOPMENT of the use of toolbar mounted single-seed drills is reducing the labour requirement of thinning, but of itself this does nothing to reduce the time needed for inter-row hoeing. One method of getting accurate hoeing of root crops with a single operator is to use a mid-mounted or front-mounted hoe, but unless the positioning of the toolbar and the construction of the tractor allow good visual control of the hoes by the tractor driver, accurate work, particularly towards the end of a long day, is difficult to maintain.

Rear-mounted steerage hoes, with an operator constantly engaged in following the rows, can result in very accurate work, but putting a second man on for this task adds considerably to the cost of the hoeing operation, while the addition of the steerage mechanism adds to the first cost of the hoe.

To overcome these objections, the N.A.A.S. Machinery Advisory Service of the Northern Region, in conjunction with local farmers, experimented with existing toolbars fitted with a steerage fin or mole. The fin, which is fitted first for the drilling operation, cuts a thin channel in the soil, 5-6 inches deep. In suitable soils this channel remains substantially unchanged for several weeks. During subsequent hoeing operations, the fin follows precisely the same channel and the hoes follow the drills with great accuracy. A further advantage is that the work can be done at higher speeds than with normal hoeing methods. More than ten years' experience of the method on farms in the north has proved its practicability.

Basic requirements are:

1. It is essential to use the same toolbar for drilling and hoeing.
2. The fin must be mounted rigidly on the toolbar, and this usually calls for bracing.
3. The toolbar must be free to swing, both when making the original slit and when hoeing.
4. The hoe must always run in the same direction as the drill.

The fin

Fig. 1 (p. 498) shows a sketch of a reversible fin which has proved successful in practice, though some deviations from these measurements may be satisfactory. A steek plate of ¼-½-inch thickness has proved suitable. The leading edge of the fin should be given a forward slant to assist penetration and maintenance of working depth. The figure also shows two sets of mounting holes, including front stay holes, at about 1½-inch centres between upper and lower sets. Under some conditions (very heavy land) it may be adequate to work at the shallower setting.

The fin should be set in a central position on the tool frame (midway between the second and third unit on a 4-row drill or hoe).With a 5- or 7-row

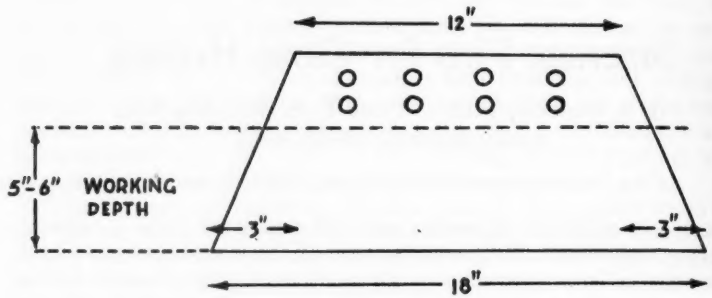

Fig. 1. Reversible Fin.

unit, the steerage fin must, of course, be offset, and though this works satisfactorily in good conditions, an even number of units is the more reliable arrangement. In very loose, light land it may improve the holding qualities of the channel if a 1-inch diameter mole is welded to the bottom of the fin.

Fig. 2 shows a typical arrangement of the fin on the toolbar. As the design of the tool frames is so varied, no particular method of construction can be recommended, but it is essential for the mounting to be robust. It may be necessary with some toolbar frames to reinforce the main support beam, or even to construct a sub-frame assembly.

The leading edge of the fin should be well forward on the toolbar to give both quick steering response and to allow room for the central "A" hoe. It is usually desirable to brace the forward end of the fin or fin support bracket. The steerage fin is not recommended for use where there are outcrops of rock, or where there are pockets of large gravel or sand.

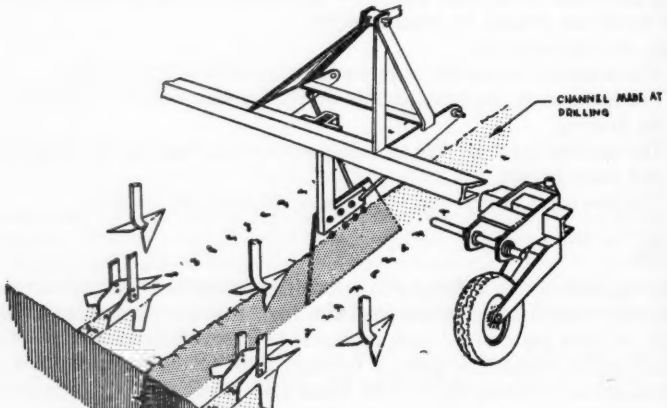

Fig. 2. Typical arrangement of the fin on the toolbar.

Use in the field

It is of prime importance that the second or subsequent bouts with the steerage fin hoe should follow in the same direction as the previous bout, and if necessary some form of marker may be used to indicate the entry point. To ensure easy entry and to allow the fin to cut to its working depth before the row of plants is reached by the hoes, the headlands must be well worked.

Farmers who have a suitable toolbar can try this method quite cheaply. Benefits include not only labour economy, but also the improved efficiency that comes from doing the work at the right time.

Accelerated Freeze-Drying of Food

THE publication this month of the book *The Accelerated Freeze-Drying (AFD) Method of Food Preservation**, puts on record the most significant achievement of the Aberdeen Research Establishment of the Ministry of Agriculture, Fisheries and Food, which closed in March.

As a solution to the problem of preserving food to meet modern demands, canning has long held pride of place; for it allows vast quantities of seasonal foodstuffs to be processed, stored and transported at reasonable cost, and yields products which are highly acceptable and very convenient to use. But it has its limitations, some of which stem from the need to sterilize the contents by heat treatment, as a result of which the products are changed in flavour and texture and usually need to be in a fluid medium. There is a certain limited reduction in nutritive value, although this is of little importance in a mixed diet. For military situations, and in other emergencies, the weight and bulk of canned foods are disadvantageous.

More recently, freezing has made great advances, and can provide preserved foods of higher quality and wider variety. The absence of heat treatment leads, in general, to better texture and flavour; and since it is possible to freeze raw foodstuffs, a greater choice of cooking methods is offered than with canned goods, though pre-cooked frozen foods are of great convenience, requiring only warming before serving. The provision of frozen foods, however, requires the establishment of a complex and expensive chain of low-temperature storage and transportation facilities which have to be paid for, and which do not exist universally.

Dehydration as a method of food preservation has hitherto failed to attract, although it is an age-old process. Since about three-quarters of meat and fish and possibly nine-tenths of fruit and vegetables are water, the possible saving on packaging, storage and transport of dried foods has been well appreciated in war-time, but until now technical advances lagged behind requirements. The only considerable commercial process available has been by air drying, but this limits plant products to powders or small pieces and

*H.M.S.O. 12*s.* 6*d.* (13*s.* 5*d.* by post).

animal products to pre-cooked minces. Such products are light in weight relatively though significantly not completely stable, and reconstitute after fairly long soaking in water to foods which usually differ markedly in flavour and texture from the original. While advances have been made recently in air-drying techniques (not least in the M.A.F.F. Experimental Factory), the process still has fundamental disadvantages.

Freeze-drying, on the other hand, eliminates many of these. It is a process whereby food, raw or pre-cooked, in large or small pieces, is frozen and then has the ice evaporated away in a vacuum chamber. In such a fashion there is yielded a product which is acceptable in form (e.g., chops and steaks, whole fruits), light in weight (having lost all its water), stable without refrigeration (if packaged to keep out moisture and oxygen), almost unchanged in flavour, texture and nutrient content (because of the low temperature of processing), and reconstituting at once on the addition of water to substantially the original condition.

The basic principles have been used for years on a commercial scale for processing high-priced biochemicals and pharmaceuticals (e.g., blood plasma and penicillin); but the achievement of the M.A.F.F. Research Establishment has been to speed up the long, expensive process and to demonstrate on a commercial scale its feasibility for food preservation.

Following this lead, several firms abroad have already gone into commercial production of freeze-dried foods and others, in the U.K. and abroad, are showing considerable interest and conducting experiments which will enable them to judge the appropriate and rewarding place of this new addition to our methods of food processing.

S. W. F. HANSON

★ NEXT MONTH ★

Some articles of outstanding interest

WHY PLAN? *by H. Burr*

TIME IS MONEY *by A. S. Christensen and G. P. Print*

COMMERCIAL SWEET PEA GROWING *by J. Hardy*

STILLAGE HANDLING OF POTATOES *by F. H. Watts and J. G. Milsom*

Farming Cameo: Series 2

44. Drayton, Shropshire

W. ROLLO, B.Sc.
District Advisory Officer

A COUNTRYSIDE of gentle slopes, broad valleys and sluggish streams, the Drayton district is the north-east portion of the Shropshire Northern Plain and adjoins Cheshire, Staffordshire and Flintshire. The average elevation of the land is about 250 feet, with much of it under 200 feet, but the flatness is relieved by a band of sandstone hills, rising abruptly from the plain to their highest point of 674 feet. Most of the streams and watercourses drain into the Roden and Tern, tributaries of the Severn, but in the north the water flows into the Weaver, a tributary of the Mersey.

Apart from agriculture, there are few industries, and the two towns, Whitchurch and Market Drayton, about ten miles apart, each have their weekly street and stock markets. Sections of the Shropshire Union Canal and its branches, which once carried many goods from the Midlands towards the Mersey, pass through the district.

Much of the Drayton district is on Triassic sandstone, but there is a considerable area of Lias clay and a small area of Permian rock. In the north, along the Cheshire border, is a large block of very heavy loam, usually shallow, overlying clay. South of this the texture is generally light-to-medium loam, but there is also some "blow-away" sand and several considerable areas of heathland, now virtually all reclaimed, with a blackish sandy soil. On the west side of the district is an area where the soil is a mixture of peat, sandy loam and clay loam, frequently all occurring in the one field, which culminates in Whixall Moss. Peat is cut on the Moss for fuel which is sold or used locally, for litter and for horticultural purposes—the latter having developed into a considerable industry.

Traditionally, the farm economy has been based on milk production with pigs and poultry as subsidiary enterprises, and, even today, there are few holdings where milk is not produced. It is a district of small farms with an average area of 45 acres and relatively few holdings over 150 acres. Scarcity of labour due to the development of various light industries locally having drawn many workers away in recent years, has accelerated an increasing tendency towards family farms.

Because of the flatness of the countryside, water moves away slowly and drainage is difficult over much of the district. This factor, as well as soil texture, has determined the use of the land. On the heavy land of the north and centre, all-grass holdings predominate—chiefly permanent grassland. Damage by poaching on this land has always been a problem and in most years limits grazing. Ploughing, when resorted to, is usually for direct reseeding, or for pioneer crops preparatory to the sowing of long leys.

On the freer-draining and more manageable soils, the growing of stockfeed and cash crops, and the use of temporary leys are usual. The southern part of the district is virtually part of the east Shropshire arable area, and cash

cropping is extensive. Apart from 2-3 year leys, Italian ryegrass is much used for early grazing and silage. Other stock crops are kale of various types and smaller areas of mangolds, swedes, and rape. At one time mixed corn was used widely but now the principal cereal is barley. Spring and autumn wheat are also grown quite extensively, while small areas of oats and rye occur. Sugar beet, potatoes and carrots are the chief root cash crops, and despite late frosts in some years, early potatoes are usually successful. A farmer-owned pre-packing station in the district absorbs considerable quantities of locally grown potatoes and carrots.

Silage is made on the majority of farms—on many regularly—but self-feed systems have not, as yet, become popular. With the recent influx of forage harvesters, very often shared by farming members of a family, the average quality of grass cut, and the silage from it, has improved. With the encouragement provided by the Silo Subsidy Scheme, many confirmed silage-makers have, to their advantage, put their silos under cover.

Drayton district is in an area subject to late frosts and so market gardening and fruit growing are limited. A demand, started last century, for ox-cabbage plants led to the establishment of market gardening on Whixall Moss. A few horticultural holdings are also found in other parts of the district.

Besides the Crown, the County Council and a University Trust, several private estates own considerable acreages in the district, but the proportion of owner-occupiers is high and increasing. The Farm Improvement Scheme has been used extensively, and the standard of fixed equipment has been much improved as a result.

Farmhouse cheesemaking, accompanied by rearing of whey-fed pigs, was widespread earlier in the century, and the Dairy Shorthorn was virtually the only milk breed found. Now most of the cattle are Friesian type and the other milk breeds—Ayshire, Shorthorn, Jersey and Guernsey—are much in the minority. Although orthodox cowsheds house most of the milk cows, more and more of the larger holdings are swinging towards yard-and-parlour systems. Cost and scarcity of labour have influenced this change, but the problem of replacement of old and inefficient cowsheds is often more vital. Of those now making farmhouse Cheshire cheese, some twenty are in the Drayton district. Grading results of recent years reveal a high degree of skill.

Once a complement to cheesemaking, pigs continue to play an important part in the farm economy. Many of the larger and cheese farms, as well as the very intensive smaller holdings, feed large numbers of pigs. Most of these pigs come from the many breeding sows also kept in the district.

Poultry keeping too has long been a practice on most holdings, and with modern methods of husbandry numbers have increased. Deep litter housing is now widespread, and more recent developments have been broiler production and the provision, on contract for hatcheries, of eggs from specialized types of poultry.

Formerly sheep were found on many holdings in the district but by the 1940s their numbers had decreased considerably. In recent years, however, they have tended to increase, either as regular or as "flying" flocks.

Except on the few non-dairy holdings, beef cattle—stores or fattening—occur only as a sideline as the progeny of dairy cattle crossed with beef.

Drayton district is, in brief, a milk-producing area of mostly small family farms on which stock is kept very intensively.

Your Fixed Equipment

Over-capitalization

P. F. Easto, F.L.A.S.
Agricultural Land Service, Oxford

In recent years owners and owner-occupiers have made a serious attempt to improve, adapt or provide new fixed equipment on agricultural holdings. The need to make good accrued dilapidations dating from the early 1930s; redundancy of buildings due to new farming methods, and the realization that a better layout is more conducive to efficiency of management and economy of labour resulting in lower production costs, gives the landowner a real opportunity to re-assess his existing fixed equipment in the light of modern requirements. Rightly he should seize the opportunity of providing more up-to-date and adaptable buildings with a minimum of maintenance costs, but in his anxiety to take advantage of the opportunities now before him, he should not overlook the real possibility of over-capitalization. This is particularly so in the case of the owner-occupier, who is in a very special position when investment in buildings is being considered. To him, land ownership is secondary to his farming business, and for this reason the opportunity to improve the income of that business often masks the danger of over-capitalization, with its risk of capital loss on sale or through redundancy. Short-term considerations often weigh with this class of owner. There is always the urge to seize the opportunity for profit when some commodity price is high, and many who have allowed the urge to dictate their decision have later ruefully reflected on their loss.

There are situations in which a farmer who owns his holding will be well advised to make additions and improvements to his buildings. Before he does so he should take stock of his farm, his management policy, the capital cost of changes he has in mind and, finally, the expected changes in his revenue account. In this way he will be able to judge whether the effort and expenditure on his contemplated management changes are justified by his anticipated financial position at the end of the day. Even then he should be very careful to avoid over-optimism induced by the paper figures, for every farmer knows how treacherous they can be. A critical examination of the figures, combined with an equally critical assessment of the likelihood of the improvement maintaining a value close to its cost, and both subjected to the average farmer's inherent common sense, will go a long way towards protecting the owner-occupier against over-capitalization.

Land ownership, prudently administered, can be a sound investment, but unless serious consideration is given to the principles of capital investment and returns, sinking funds for the eventual replacement of fixed equipment, and maintenance costs on the one hand and land capacity on the other, the injection of capital into land and fixed equipment can be anything but a sound investment and may even result in capital loss.

One may ask what is meant by over-capitalization. The owner must obviously look upon his land and fixed equipment as part of his capital and

expect a reasonable return from his investment. Any expenditure, therefore, which cannot be justified by the return and which cannot be recouped on sale would amount to over-capitalization. In examining what a reasonable return on capital would be, one must take a comparable return on "outside" investment over a long term with similar security and allow additionally, in the case of fixed equipment, a sinking fund for replacement at the end of its useful life, plus recoupment of cost of maintenance. It must not be forgotten, however, that we are dealing with landed property. An owner may have considerations other than return on capital which he wishes to take into account—such as amenity, prestige and an obligation to his tenants and their welfare.

Over-capitalization may be readily recognized in the form of over-specialized fixed equipment which, in changing times, could become redundant comparatively quickly. Furthermore, the provision of fixed equipment which depends for profitability not on the land to which it is attached but upon purchased feedingstuffs, would amount to over-capitalization. It is, however, a little more difficult to recognize when normal types of fixed equipment are provided, but the test will be whether the expenditure involved can be justified by the return by way of increased rental value within the capacity of the land. In an endeavour to keep in perspective the prudent investment of capital in landed property, with a view to avoiding over-capitalization, it is clearly necessary to assess the capacity of the land for production purposes, because to provide long-term fixed equipment in excess of land potential in order to take advantage of a short-term boom in a particular commodity, is short sighted indeed. Also, with the present high cost of new fixed equipment, a review of all existing buildings and their adaptation can often reduce the amount of capital required to provide adequate buildings for the efficient farming of the land. Where, however, new buildings are fully justified from an investment aspect, these should, as far as possible, be adaptable to allow for changing farming techniques and circumstances.

Provided expenditure on the provision or adaptation of fixed equipment shows a satisfactory return and due consideration has been given to the question of over-capitalization, it is sound policy to provide capital for this purpose, because it maintains or improves the rental value and capital value; better layout of buildings improves efficiency which, in turn, leads to increased productivity and lower production costs; also adaptable buildings reduce the possibility of obsolescence in changing times. One should, however, avoid the provision of fixed equipment in isolation merely to solve an immediate problem, as experience shows that the application of piecemeal remedies can be a serious contributory cause of over-capitalization. All fixed equipment should be considered and planned comprehensively and any individual proposal should fit into the comprehensive plan. This may well obviate the early redundancy of a perfectly good building which, for lack of foresight, has been wrongly sited in relation to other buildings or circulation of stock.

Finally, it should not be assumed that the existence of buildings alone is a sound reason for improving or replacing them. Any proposal should be considered in relation to the land which it has to serve, the use to which it is to be put and with a view to increased efficiency and economy of labour. Whether one maintains, improves or provides new fixed equipment, it must be carefully examined in relation to the size of the holding and against the background of the economic prospects of agriculture.

At the Farmers' Club

Prospects in the Market for Milk and Milk Products

RECALLING that on the previous occasion, 20 years ago, on which he had addressed the Farmers' Club he had spoken of the urgent need for producing more milk—"our industry has certainly changed since then"—on 8th November, Mr. J. L. DAVIES, general manager of the Milk Marketing Board of England and Wales, turned to marketing problems. He forecast a continuing rise in U.K. milk production of more than 40 million gallons a year, which is the average rate of increase over the past 10 years. "The question, therefore, is what do we do with this growing volume of milk?" he said. "The prosperity of the dairy industry, of farmers, distributors and manufacturers, in the next few years, will depend largely on our success in sustaining this trend of increasing output on the farms by a corresponding expansion of the markets for liquid milk and cream."

There is no doubt that the promotion and advertising effort of the last few years has successfully increased sales and expanded the market for milk. Millions have been spent, said Mr. Davies, and we must spend more still, and conceive of selling and merchandising our food products as something much bigger and deeper than the traditional approach suggests. In the end it is the farmers' job, through their organization, to see that the selling end does not flag and let them down. But selling is not the only thing that matters. "The quality of milk and dairy products counts enormously, and so does the processing, packaging and presentation, research, and finding new ways and new products, and perhaps above all in milk, the service to the customer in her home, every day of the year."

"While we struggle to find a bigger market for our substantial, but still modest, increase in supply in this country, we keep a wakeful eye on trends abroad", said Mr. Davies, "and the prospects of considerable excess supplies in Europe alone make us doubtful whether this country should remain the only free market for dairying surpluses where they arise".

Since we buy half our milk (mostly as butter and cheese) from overseas, trends in Europe and the Commonwealth have an important bearing on our markets. Broadly, both in the U.K. and Europe generally, milk output has risen by about 2 per cent a year, compared with 1 per cent a year in North America and the Southern Dominions, over the past decade. The efficiency of the dairy cow has increased very rapidly during this period. Small farmers everywhere produce a large proportion of the milk supply—"the progress of our own small farmers in this respect has been outstanding".

In several European countries and in the U.S.A. liquid milk consumption is tending to fall. Butter, the most important single milk product in world markets at present, has a vigorous competitor in margarine, to which U.K. dairy farmers have lost the milk equivalent of over half a million cows a year. Butter prices are kept so high in the U.S., Canada, Australia and Germany that the much cheaper substitute has secured a large market.

Further, where high butter prices depress domestic consumption—and surplus milk is usually made into butter—this finds its way to the British market, reducing its price to crisis level below the production costs even in New Zealand. The prospects ahead for the butter market are gloomy in the extreme unless action is taken to prevent dumping.

In the Common Market countries, experts have forecast that by 1965 the number of cows will be nearly 14 per cent higher than in 1956, yields will be 10 per cent higher and production of milk 26 per cent higher, i.e., an additional 2,600 million gallons more in 1965 than in 1960—just about equal to our total U.K. output. Allowing for increased consumption, a Common Market surplus of some 1,000 million gallons is expected by 1965. "European countries must do more to increase home consumption of milk and milk products", declared Mr. Davies, "nor does it make sense for dairying countries to eat margarine and export their dairy products at subsidized prices". Milk is a problem commodity which concerns us, whether or not we join the Common Market. Yet the surplus we anticipate is small in relation to the size of the milk industry and world needs—in the under-developed areas of the world there is a growing demand as standards of living rise. Widely fluctuating prices are a hindrance to the achievement of maximum consumption. "It is not enough to talk vaguely of giving milk away. We need an organization of the Western countries to build demand in less-developed continents to take the excess from thriving dairy industries in the West."

If we join the Common Market, we broaden the base and increase the scope of our problems, but in the end the problem is world wide, and it is not a big one if it can be handled by countries acting together. Through their own organizations, farmers of the world should do much more to regulate and stabilize market prices. "More milk can be produced on farms, and consumers do not expect and do not need primary foods at prices below the real costs of production."

SYLVIA LAVERTON

OXFORD FARMING CONFERENCE

January 8-10, 1962, in the Town Hall, Oxford. Subject: *The Business of Farming.* Enquiries regarding Residence and Conference and Dinner tickets should be addressed to the Hon. Secretary, M. H. R. Soper, Esq., O.B.E., at the University Department of Agriculture, Oxford.

Agricultural Chemicals Approval Scheme

Additions to the 1961 List of Approved Products

THE following additional products have been approved under the Agricultural Chemicals Approval Scheme. The first list of Approved Products was published on 1st February, 1961.

INSECTICIDES

DIAZINON—*Atomising Solutions*

Basudin Mushroom Aerosol—W. Darlington & Sons, Ltd.

TETRAHYLORODIPHENYLSULPHONE

A persistent organic acaricide for the control of fruit tree, red spider mite, and red spider mite eggs; and young active stages.

Liquid Formulations

Midox Tedion V-18—Midox Agricultural Division of Rentokil Products, Ltd.

HERBICIDES

2, 4-DB *Sodium Salt Formulations*

Embutox—May & Baker, Ltd.

DICHLORPROP

A translocated phenoxypropionic compound for the control of redshank, black bindweed and certain other weeds in spring- and autumn-sown cereals.

Liquid Formulations

Cornox RK—Boots Pure Drug Co., Ltd.
Marks Polytox—A. H. Marks & Co., Ltd.

MCPB *Sodium Salt Formulations*

Stancide MCPB—S.D.C. Pesticides, Ltd.

MCPB WITH MCPA *Potassium and Sodium Salt Formulations*

Stancide Plus MCPB/MCPA—S.D.C. Pesticides, Ltd.
Tropotox Plus—May & Baker, Ltd.

METHOXYCHLOROBENZOIC ACID WITH MCPA

A substituted benzoic acid with MCPA for the control of weeds, especially those resistant to MCPA alone, e.g., black bindweed, chickweed, knotgrass and redshank, in cereals.

Potassium and Sodium Salt Formulations

Banlene—Fisons Pest Control, Ltd.

2, 4, 5-*T with* 2, 4-*D* *Ester Formulations*

Econal—Baywood Chemicals, Ltd.

MISCELLANEOUS

METHAM-SODIUM *Liquid Formulations*

Sistan—Plant Protection, Ltd.

Reminder: Seeds Dressings and Risks to Wild Life

Dressings containing dieldrin, aldrin and heptachlor can kill birds that eat treated seeds. Great care should be taken not to leave any treated seed lying about when it is being stored or sown. Higher strength dressings for wheat bulb fly should be used only on winter wheat and then only in areas where there is a real danger of attack. Dressings containing dieldrin, aldrin and heptachlor are not to be used at all for spring-sown grain.

THE MINISTRY'S PUBLICATIONS

Since the list published in the November, 1961, issue of *Agriculture* (p. 446) the following publications have been issued.

LEAFLETS

Up to six single copies of Advisory leaflets may be obtained free on application to the Ministry (Publications), Ruskin Avenue, Kew, Richmond, Surrey. Copies beyond this limit must be purchased from Government Bookshops, price 3d. each (by post 5d.).

ADVISORY LEAFLETS

No. 11. Winter Moths (Revised)

No. 68. Carrot Fly (Revised)

No. 109. Flea Beetles (Revised)

No. 124. Pruning Plums and Cherries (Revised)

No. 183. Narcissus Flies (Revised)

No. 363. Sugar Beet Pulp for Feeding (Revised)

No. 421. Cereal Root Eelworm (Revised)

No. 451. Wasps (Revised)

No. 502. Dwarf and Climbing Beans in the Open (New)

FARM MACHINERY LEAFLETS

No. 14. Field Crop Sprayers (Revised) 6*d.* (by post 9*d.*)

No. 25. Farm Seed Cleaning and Grading Machinery (New) 6*d.* (by post 9*d.*)

OTHER PUBLICATIONS

Experimental Horticulture No. 5 (New) 5*s.* (by post 5*s.* 5*d.*)

Describes tests made on new varieties of fruits and vegetables raised by plant breeders—crops under experiment range from carnations to cauliflowers, and the nature of problems arising from propagation to the control of pests and diseases.

N.A.A.S. Quarterly Review Vol. XIII, No. 53 Autumn 1961 1*s.* 0*d.* (by post 1*s.* 5*d.*)

In Brief

CARROT MOTLEY DWARF VIRUS IN LANCASHIRE

Some carrot crops in the Ormskirk area of Lancashire have not done at all well this season. The tops stopped growing in early August and the field lost colour until it presented a motley picture of yellow, red and green, with too much soil visible between the rows. Trace element deficiences were suspected but with no confirmation from chemical analyses or test applications of minor nutrients. The first clue to the nature of the disorder came when sap from diseased plants was applied to virus test plants and the reactions indicated that carrot motley dwarf virus was present.

Originally discovered in Australia, the virus was found in England in 1956. Although this year is the first time that carrot motley dwarf virus has been confirmed on carrots in Lancashire, it has probably been with us a number of years, some seasons worse than others, and particularly serious this last summer. Other serious outbreaks are reported from East Anglia and Yorkshire.

Diseased carrots are stunted, with yellow and green mottling of the foliage. The fronds are often twisted and develop reddish tints which may be a virus symptom or the result of aphid feeding. Diseased roots are smaller than normal and may have an excess of lateral fibrous root. The earlier a crop is infected the worse the symptoms appear.

The virus is spread by the willow-carrot aphid which overwinters on the willow, where it multiplies in the spring until the weather is suitable for migration. Then it flies off to infest carrot crops and wild carrots.

The marked difference in infection between crops, sometimes only a few fields apart, has led local growers to suspect that the virus is transmitted in the seed. But few viruses are in fact seed-borne and there is no scientific proof yet that this is one of them. Differences in varietal susceptibility and in the degree of symptom expression, as well as in the time and extent of aphid infestation, could also produce this effect.

It is still too early to judge what the loss in yield will be, as backward crops are only just being lifted. But in Australia and New Zealand, where the disease has been investigated for a number of years, experimental results show that early varieties, which are all susceptible, may, in severe attacks, suffer a 50 per cent loss in yield. Experience there suggests that late sowing, to avoid the heaviest flight of aphids, and spraying fortnightly with insecticides as soon as the carrots emerge, may succeed in preventing serious loss.

In our conditions it is unlikely that any advantage is to be gained by delaying sowing because, in the absence of disease, earlier sowing means earlier crops and better yields. But there are already indications that insecticides could be effective. Many carrots in the Ormskirk area are grown on contract, and one contract this year asked for the carrots to be sprayed with a systemic insecticide starting at the four true-leaf stage. There was no serious trouble in any of these crops. This is in line with theoretical expectation because carrot motley dwarf virus is a persistent virus, like sugar beet yellows. The time required by an aphid to acquire or transmit the virus is generally long enough for the insecticide to do its job before any virus transmission has taken place.

The carrot motley dwarf virus is currently being investigated at Rothamsted Experimental Station.

L. J. Cock

IN BRIEF

BRACKEN GRAZING BY SHEEP

Bracken is a pest. On hill grazings it covers an enormous area, usually on the better soils. Its value as bedding—manifest by the increasing acreage being mown, baled and carried every year—does indeed mitigate its status to some extent, but certainly not enough to offset the loss of grazing which it causes. On the open hill, stock normally avoid bracken at all stages of growth, and this is especially true of sheep. The poisonous nature of bracken, too commonly shown by losses of cattle and horses, is well known, but sheep, although not altogether immune from the poison, apparently never suffer from it in Britain.

Why bracken should normally be unpalatable to sheep is perhaps worth asking—the more so since the fronds carry nectaries which, in warm weather, secrete droplets of nectar, sometimes large enough to trickle down the stem; these are sought by insects and might be expected to attract herbivores. It is tempting to suppose that the unpalatibility of the plant, is connected with its toxicity.

Any *persistent* grazing of bracken by sheep must be considered remarkable. This has been observed for several years at a number of places on hill grazings in Brecon, Radnor, Monmouth and Glamorgan. At these places, the sheep of the "acclimatized" hill flocks selected certain areas of bracken—at first, usually small patches often within much bigger blocks—and year after year grazed the fronds. The grazing goes on throughout the plants' growing season, not only on young fronds but also on fully mature and fibrous growth. The animals bite the main stem of the frond or, after its expansion, more commonly strip its lateral branches or pinnae. The attack on the bracken spreads from year to year, eventually covering sizeable areas; also, new foci of grazing appear, often some way from the existing attacked areas. The marginal spread of grazing is checked by any natural break, such as that made by a small stream, even of only a few feet, in the continuity of the bracken. Sooner or later, it seems, these gaps are likely to be "jumped" by the establishment of a new focus of grazing in the fern on the other side.

The grazed areas of fern are all weakened more or less drastically, depending on the intensity of the grazing. The most striking cases have resulted in complete clearance of bracken in 3-4 years from patches where it was originally so vigorous that no other herbage grew. On other areas, the sheep appear to lose interest in the fern before it is totally eradicated, but leave it so reduced that it can interfere little with the sward below. At the sites under observation, tens of acres of grazing have thus been cleared. The sward which develops on the bracken litter is distinctly of better quality than that on the body of the hill, being largely of *Agrostis* rather than *Nardus* and fescues. When protected from grazing, the growth of the fern appears normal.

There is no evidence that the sheep, which in some places must have been getting a large part of their diet from bracken, have suffered ill-effect in any way. Indeed the farmers have noticed an improvement in the animals from the better grazings that have developed.

Much more bracken has been grazed in 1961 than in previous years: it is to be hoped that this will continue. Indeed, if the change in palatability of the fern was found to be artificially transmissible, it could prove a new, biological weapon against one of our most recalcitrant weeds.

R. GARRETT-JONES

FLOW METERS FOR MILK COLLECTION

The Milk Marketing Board are trying out the idea of fitting flow meters with ticket-printing machines to their milk tankers. The amount of milk collected at the farm would, we understand, be recorded automatically on duplicate tickets to within one-tenth of a gallon. Milk temperature, and farm code number would be added by a rubber stamp. The top copy would be handed to the farmer and a carbon copy kept on the reel for the buying dairy.

IN BRIEF

SHEEP RECORDING AND PROGENY TESTING

The Committee on Sheep Recording and Progeny Testing, under the chairmanship of Mr. Ivor Morris, has made its recommendations (H.M.S.O. price 2*s.* 6*d*, 2*s.* 10*d* by post). The various kinds of flocks found in Great Britain are classified, with a description of their functions and attributes. The characters of prime economic importance in lowland flocks are shown to be prolificacy, milking capacity, growth rate and carcass quality, together with fleece weight and quality in some flocks; in hill flocks the most important are hardiness, fleece weight and quality, and prolificacy. Possibilities of improving these characters through breeding and management are discussed, but it is emphasized that limitation of objectives in a flock is essential to such improvement. The benefits that individual sheep recording can bring to industry, both in commercial and stud flocks, are suggested—probably the most important is an aid to management. Progeny testing, or some other form of family selection, must be adopted if the more weakly heritable economic characters of sheep are to be improved. Considerations of the best breeding methods for specific objectives are indicated for the guidance of the individual flockmaster, and specimen breeding schemes, designed to achieve specific objectives, are described.

IT'S YOUR PIGEON

The I.C.I. Game Research Station at Fordingbridge has produced an outstandingly good colour film, *It's Your Pigeon*, dedicated to the death and destruction of woodpigeons, which at a minimum estimate are said to eat 500 tons of food a day, 80 per cent of which is farm produce! Its focus is primarily on shooting over decoys, with the use of camouflage netting and hides and, for all its lighthearted commentary (perhaps because of it), the film makes its many useful points very effectively. Farmers and landowners should clamour to see it.

Running time 45 minutes, with never a dull moment.

FEES FOR POST-MORTEM EXAMINATIONS OF POULTRY

To make the service fully self-supporting, fees for post-mortem examinations of poultry at the Ministry's Veterinary Laboratories have been increased (as from 1st December, 1961) to 27*s.* per report on adult birds and growers over four weeks of age and to 40*s.* per report on batches of chicks. The fees for examinations of small animals such as rabbits, mink and cavies are the same as for adult birds and growers.

The lower fees, which were introduced on 1st December, 1960, represented no more than an intermediate step in bridging the gap between current costs and those which obtained when the service was introduced in 1925. The fees will be reviewed periodically, so that they may be kept in line with costs.

The free service under the Poultry Stock Improvement Plan is not affected by this action.

CONSTITUTION OF COVENT GARDEN MARKET AUTHORITY

Sir Ian Jacob, G.B.E., C.B., has been appointed the first Chairman of the Covent Garden Market Authority, which was constituted on 30th October, 1961. Mr. Frank Hollins, C.B., seconded from the Ministry of Agriculture for a period, has been appointed Managing Director and a member of the Authority.

Book Reviews

Making and Feeding Silage. JOHN MURDOCH. Dairy Farmer (Books) Ltd. 25*s*.

A new book by a recognized authority on a complicated subject is always welcome. Dr. Murdoch has been responsible for much original work on silage in recent years at the National Institute for Research in Dairying and the results obtained and experiences gained are woven skilfully in the fabrics of the book.

The arguments for and against using silage are discussed in a completely unbiased manner and the principles involved in silage-making are clearly established and emphasized. Grassland herbage is rightly pinpointed as the most important raw material for silage-making in this country and the various types of silo are described in general terms and their merits compared. Harvesting methods and the use of various additives are discussed and, finally, the all-important problem of the correct feeding of silage is admirably dealt with.

As a result of recent research, the significance of temperature in the making of silage has undergone a change of emphasis, and Dr. Murdoch states that it is an indication of how fermentation in the silo is proceeding, rather than an end in itself. The importance of ensiling high dry matter material is very rightly stressed, for it is one of the vital factors in ensuring both the success of the fermentation process and the feeding value of the final product. The need for thorough mixing of additives with the forage is also essential, as he points out, if disappointing results are to be avoided. Having produced a crop of high feeding value, a costly business in these days, the author properly points out that wastage, both during the ensiling process and afterwards when feeding the product, must be avoided.

Although this book is obviously written for farmers and prospective farmers, it would have been more helpful to a wider circle of readers if full references were given to the sources of information. To avoid complicating the text, this could have been achieved by the addition of a full bibliography; this would have been invaluable, especially as Dr. Murdoch is so well placed to supply it. Confusion could possibly arise from the fact that certain tables do not indicate whether analyses refer to silage on a dry matter or a fresh weight basis, and "protein" content is not defined until almost the end of the book. It is perhaps a little dangerous to suggest that tarpaulin sheets can be used to protect silage, because the life of such sheets is very short indeed if they come into contact with silage. The statement in the last chapter that silage for ewes should be of reasonable quality is rather misleading, for experience shows that sheep will only eat, in quantity, the very best silage; and only the best is given to them by wise farmers. These are minor points, however, which can be corrected in a new edition; they do not detract in any way from a book which is likely to be valued by farmers and students alike.

R.J.H.

Place of Stones. RUTH JANETTE RUCK. Faber and Faber. 21*s*.

This is a thoroughly enjoyable book. It is very readable and will appeal to all who are interested in practical farming, but more especially to those concerned with hill sheep.

Miss Ruck and her father and mother, over whom she must exercise considerable influence, are to be congratulated as a town family from England on their courage and fortitude in not only taking a hill farm but in taking one which is virtually in a "foreign" land—the slopes of Snowdonia. In this connection, however, it is interesting to note the welcome and the material help which Miss Ruck received from her Welsh neighbours. The moral could be that there is no more international language than farming—especially hill sheep farming.

Carneddi is a farm, typical of many in the hill and upland areas of Britain, that is in grave danger of disappearing under existing economic conditions. The author has successfully demonstrated that against a solid background of hill sheep and cattle, various other enterprises can be integrated into this system of farming to provide a more satisfactory total income—in this case poultry accredited under the Poultry

Stock Improvement Plan, poultry in a deep litter house, and the propagation of virus-tested strawberry plants for the Nuclear Stock Association.

Obviously any newcomer to a hill farm who can undertake these projects successfully in addition to running sheep and cattle is well above the average in drive and initiative. In this respect the book is both a warning and an inspiration to any one thinking of taking a hill or upland farm. Its great merit is that everything at Carneddi seems to be so very real—the people, the animals and the environment, while at the same time the author writes with modesty and sincerity. One is left with the feeling that a visit to Carneddi would be both enjoyable and instructive, not only to see the farm but also to meet the author.

W.E.

Micro-Organisms as Allies. C. L. DUDDINGTON. Faber and Faber. 25*s*.

This book is neither a text book on industrial microbiology nor even a beginner's handbook on the engineering aspects, but it is interesting and easy reading. Without excessive detail, the subject of each chapter is covered from the start of the process to the finished product. In the case of beer, we are told something of hop growing and the different hops, the importance of type of water and something of beer types in other countries, not forgetting that in bygone days "beer was strong enough to keep invading micro-organisms quiet". The maturation of the main wines is discussed and the reader will find himself on the path to understanding and appreciation of good wine.

Penicillin is covered from the very beginning of Sir Alexander Fleming's work, yet with due acknowledgment to the later American work developing the modern large scale production.

It may be news to many that hard water affects the finish of bread and that the residual alcohol from the yeast fermentation, about 0·5 per cent, is part of the much liked flavour of "new" bread.

Beside antibiotic production, we are introduced to a wide range of industrial products based on yeast, mould or bacterial action. The strictly agricultural aspects are confined to cheese, silage, azotobacter and rhizobia, but considering the wide coverage of the book this is not out of place.

H.B.

Partridge Rearing: (Wintering Penned Stock, Mating in Captivity and Egg Production). (I.C.I. Game Services Booklet No. 4). Revised Spring 1961.

This booklet is one of a series of twenty-four. It is essentially practical and deals first with the problems of artificially rearing partridges from eggs bought in or salvaged from damaged or deserted nests, as a means of supplementing the shoot, apart from the conventional hedgerow keepering of wild partridge. I.C.I. rightly regard game birds as a crop that can contribute not only sport but some financial return to the farmer. Here they advise on supplementing this crop. The importance of keeper sense, the equivalent of green fingers in a gardener, is stressed as the most important attribute if the many useful hints are to be best utilized.

Hatching is generally under bantam broodies, but still-air incubators can be used successfully. Various systems of brooding and rearing are discussed, and diagrams are given. Brooder units are also discussed and illustrated. The different methods of heating are reviewed in such a way that the game farmer can see which is best suited to his particular conditions.

Nutrition and feeding systems are referred to, and information on the inclusion of coccidiostats and antibiotics included: the latter appear to be more beneficial to partridge than to pheasant chicks. Notes on the release of hand-reared broods, the release of hen birds to the wild for mating, mating in captivity and the wintering of adults in pens are based on practical experience. Lists of bantam breeders and of firms that supply the equipment mentioned in the text form a valuable appendix to a well-produced, readily readable booklet, full of down-to-earth advice. It can be obtained free from the I.C.I. Game Research Station, Burgate Manor, Fordingbridge, Hants.

W.M.A.

Crop Husbandry. R. D. PARK. Oxford University Press. 18*s.*

Primarily designed for students at farm institutes and those attending part-time agricultural courses, this book should appeal also to other readers requiring a concise introduction to the principles of crop production. It divides itself more or less naturally into three parts, covering the soil, crops and pests and diseases.

Most of the soil section is devoted to an easily comprehended account of land drainage; the remainder provides a brief introduction to the classification of soils, and to the various components which make up a soil.

The crops section includes sufficient botany to help anyone not familiar with the subject to understand a little of plant structure, and the growth and reproduction processes of plants important in agriculture. In addition it defines many of the scientific terms which are most used in farming. Cultivations, fertilizer and sowing practice, rotations and harvesting of the commonly-grown farm crops, including grass, are adequately covered.

Pests and diseases are dealt with very briefly, but again the basic information provided on insects and fungi will be most helpful to the novice. Weed control is dealt with from the cultural and chemical approach, but since this is a rapidly developing field and no text-book can hope to be up to date, this chapter might have been improved if more of the principles had been discussed.

Generally speaking this is a readable book which will provide a suitable elementary introduction to crop husbandry. The text is enhanced by the illustrations and photographs; it is unfortunate that a number of errors are present, possibly due to over-simplification.

J.J.N.

Agriculture in Britain. H.M. Stationery Office. 2*s.* 6*d.*

Originally produced as part of the widely-known *Britain—An Official Handbook*, this pamphlet starts with a brief summary of the land and its uses. It then goes on to describe the main features of Britain's agriculture—its changing pattern of production, its livestock, income and expenditure. Many interesting facts emerge. Today, despite our increasing population, the U.K. farmer produces half of all the food we eat, compared with one-third in 1939. In some commodities the proportion is even greater. Home sources supply all our milk, 99 per cent of our eggs and almost two-thirds of our carcass meat. Mechanization has also come to our farms. Britain today has one tractor for every 34 acres of arable land.

The Government, too, has played an ever-increasing part. Because we are a great trading nation we have had to seek methods of supporting domestic agriculture which do not prejudice our world trading position. To the student of the farming scene the description given of the development of modern agricultural policy since the corner-stone was laid in 1947, the complex procedure of the February Price Review, and the system of price guarantees and production and improvement grants, will make most interesting reading.

Finally, the booklet deals with the other forms of Government assistance and action in farming, such as drainage, labour legislation, disease control, research, education and the provision of technical advice.

In the space of 35 pages *Agriculture in Britain* provides as clear and comprehensive a guide book to British farming as can be found anywhere. For all those in farming it is an invaluable reference source. But probably its most useful role is elsewhere. Sent to the agriculturist overseas or the non-agriculturist in this country, it will surely save a mountain of explanation in the present popular inquiry into the "hows" and "whys" of British agriculture.

L.W.T.

The Agricultural History Review. (Volume IX. Part 2. 1961). H. P. R. FINBERG. The British Agricultural History Society. 12*s.* 6*d.*

Selions, double scaup, the 1801 crop returns, weather history since the Dark Ages, hop-growing, Celtic territorial organizations, steam ploughing—such are a few of the diverse aspects of agricultural history that the most recent issue of the *Review* brings us from the mass of material now becoming available.

In the main articles, M. A. Havinden shows from detailed studies in Oxfordshire that open-field husbandry was by no means as inherently static as is often imagined; E. R. Green summarizes the writings of Varley, an eighteenth century agriculturist who graduated from labourer via land agent to the ultimate status of a farming expert; G. Houston explores the early agricultural statistics of Scotland; and M. L. Ryder reports further investigations on mediaeval livestock remains. The remainder of the volume contains a glossary of terms used in agrarian history, reviews of nearly twenty books and a lengthy and imposing list of work in progress.

Every reader will find something to interest him in so varied a publication. But two independent sections combine accidently to raise a general question of major importance. Firstly, J. Radley tells us that the Derbyshire practice of feeding holly to sheep and cattle in winter survived into the present century but is now completely unknown to local farmers who "expressed astonishment" when told of it. Secondly, the exciting and decisive report on *The Making of the Broads*, which is reviewed in this issue, shows that the very existence of a large and long-established peat cutting industry was forgotten in a couple of centuries. Just how tenacious is this famous "rural memory"? Or, in wider terms, what weight should be given to local tradition? The general reader would like to hear the historian's answer to this question.

N.H.

Experiments in Progress No. 13. Grassland Research Institute Annual Report 1959-60. Grassland Research Institute. *7s. 6d.*

We are presented here with a very readable account of work in progress at Hurley and emphasizes the extreme complexity of research into grassland problems. It covers an immense field, embracing plant, animal and soil, and affords a running commentary on the work of the Institute. Special articles on silage, lucerne and soil problems make it of value to a wider public than is usual with reports of this nature.

Farmers will be interested in the comparison of farm silage and silage as made by Professor Martin Jones. Animals fed on silage made by the Professor had a consistently higher intake of dry matter and digestible dry matter than animals fed on silage made by the ordinary farm method. The gains per bullock per day were also greater: 1·76 lb compared with 0·74. Further work to unravel the Professor's secrets is in progress.

Writing about lucerne, the authors state that germination and seedling establishment are satisfactory at Hurley, but vigour of growth in the seeding year is frequently unsatisfactory and nodulation is poor. The condition persists into the following year and then gradually improves. Combine-drilling small amounts of lime with inoculated lucerne seed enhances the early establishment of large clusters of effective nodules on the roots.

Work on fly ash waste shows that grasses and legumes can be grown successfully on raw fly ash without adding either sludge or soil. Lucerne became well established without an application of phosphate or potash. Clovers grew well without extra nitrogen. Neither grasses nor clover responded to potash, although both appeared to benefit from phosphate during the establishment period. Grass growth was very good if supported by frequent dressings of nitrogen.

T.W.E.

Kent or Romney Marsh Sheep. G. ALLANSON. Wye College. *5s.*

This is a study, in its home area, of a British breed forming only 2 per cent of the national flock but 90 per cent of the sheep in the south-eastern corner of England. It has penetrated every sheep country of the world, and is the basic material of a great part of the imported lamb competing with local production today.

Its characteristic hardiness under the peculiar conditions of exposed lowland pastures and the valuable wool clip have, so far, maintained its supremacy in the south-east although, since the war, other breeds have increased more than the Kent, and the competition for land from arable cropping is yet another menace.

The breed's comparatively low fecundity and late maturity may be remediable, and the need for effort both in management and breeding policy to improve these

qualities would seem to be the most important of the author's findings.

The report is based on several years investigations on many farms, and the author has used the extensive records of a prominent auctioneer. Most of the tables refer to the season 1956-57—a good year for sheep in the area. The reader is warned that subsequent years have not been so good, but it would be unfortunate indeed if Table 6, which showed a net profit of £11 0*s.* 6*d.* per acre from the Romney Marsh system misled anyone into thinking that no improvement is required.

Other tables and analyses provide a tremendous number of facts about sheep in the south-east which should be studied by all sheep farmers who hope to develop a system of farming in line with the future marketing situation. Romney Marsh men will be interested to read that their belief in a high rate of stocking is fully supported by Table 11.

The report is in three parts:

Part 1.—"Sheep on the Farm" distinguishes between the Romney Marsh system and other systems of management, emphasizing the need for sheep to match the growth of grass on the former, and the subsidiary role of sheep on other systems.

Part 2.—"Sheep in the Market" considers the national trends and the position of the heavy Kent sheep in a market demanding light carcasses.

Part 3.—"Farm Adjustments to the Market" discusses the implications of the guarantee structure and its effects on the management of sheep on the farm.

A final commentary extends the reasoning to other Longwool breeds and suggests that, whilst improvement in the lamb crop is a first requirement amongst them all, concentration on this aspect of breeding instead of trying to improve in many directions might achieve results more quickly.

The report can be obtained, price 5*s.* post free, on application to the Secretary, Department of Agricultural Economics, Wye College, near Ashford, Kent.

J.A.W.

Books Received

Crop Spraying Simplified. Michael Bradford. Blackwell. 9*s.* 6*d.*

English Farming: Past and Present. Lord Ernle. Heinemann. 50*s.*

Farmer and Stockbreeder Yearbook and Desk Diary 1962. Farmer and Stockbreeder. 20*s.*

Pigs: their Breeding, Feeding and Management. V. C. Fishwick. Crosby Lockwood. 20*s.*

Potash Fertilizers: Booklet 3. Potash Limited. 2*s.* 6*d.*

Soils in Canada. Edited by R. F. Legget. Oxford University Press. 52*s.*

The Lily Yearbook, 1962. Edited by P. M. Synge and J. W. O. Platt. Royal Horticultural Society. 12*s.* 6*d.*

The Nutrition of The Young Pig. I. A. M. Lucas and G. A. Lodge. Commonwealth Agricultural Bureau. 25*s.*

The Small Farmer. Margaret Bramley. Crosby Lockwood. 15*s.*

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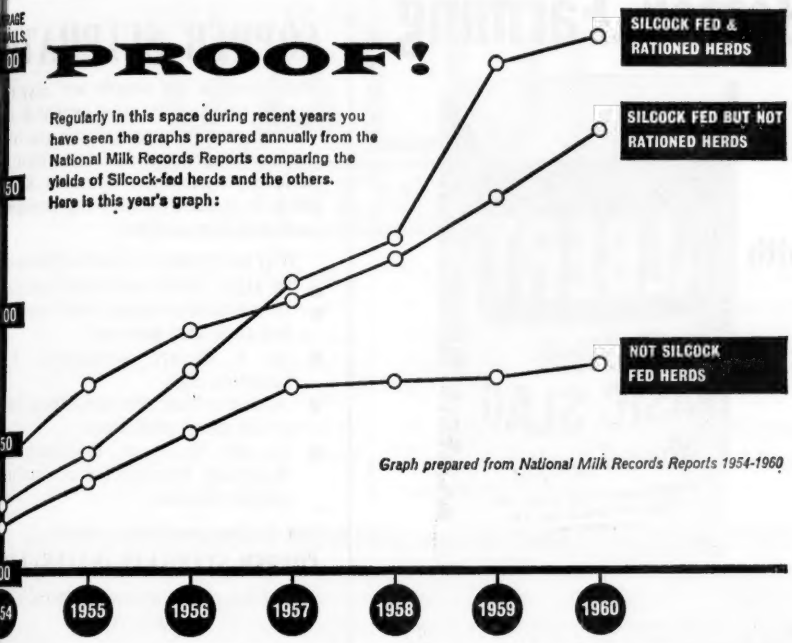

Graph prepared from National Milk Records Reports 1954-1960

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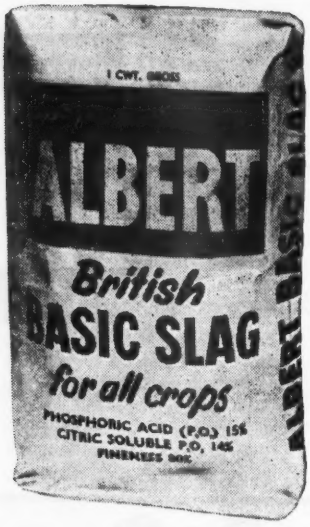

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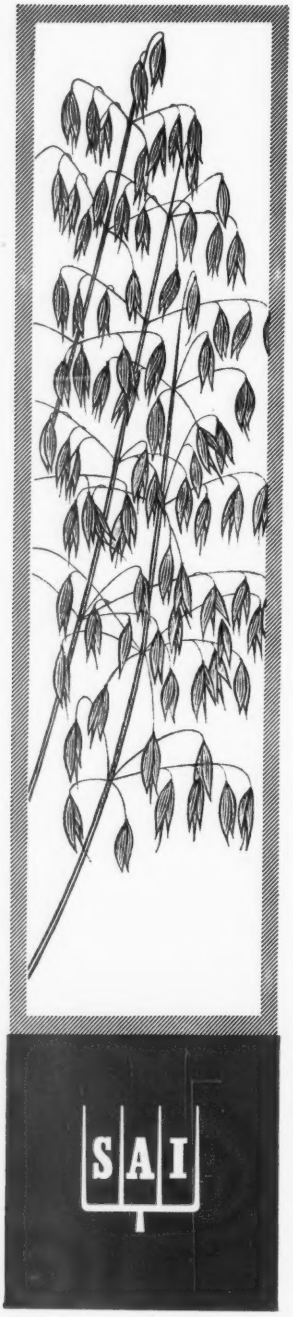

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